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**THE**  
**INFLUENCE OF CLOTHING**  
**ON HEALTH.**





THE  
INFLUENCE OF CLOTHING  
ON HEALTH.

BY  
FREDERICK TREVES, F.R.C.S. ENG.,  
SURGEON TO AND LECTURER ON ANATOMY AT THE LONDON HOSPITAL.

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*WITH ILLUSTRATIONS.*

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# CONTENTS.



	PAGE
INTRODUCTORY . . . . .	7
THE PRIMARY OBJECTS OF CLOTHING . . . . .	10
THE MATERIALS USED IN DRESS . . . . .	13
THE COMPARATIVE VALUE OF DRESS MATERIALS . . . . .	14—37
WARMTH . . . . .	15
INFLUENCE OF COLOUR . . . . .	18
HYGROSCOPIC PROPERTIES . . . . .	23
POROSITY . . . . .	26
IMPERMEABILITY TO WATER . . . . .	26
INFLAMMABILITY . . . . .	29
NON-INFLAMMABLE FABRICS . . . . .	34
POWER OF ABSORBING ODOURS . . . . .	36
ELECTRICAL QUALITIES . . . . .	36
POISONOUS DYES . . . . .	36
UNDERCLOTHING . . . . .	37—45
ADVANTAGES OF WOOLLEN UNDERCLOTHING . . . . .	37
FIT CLOTHING FOR EXERCISE . . . . .	39
OBJECTIONS TO WOOLLEN UNDERCLOTHING . . . . .	41
GENERAL FACTS IN CONNECTION WITH UNDERCLOTHING . . . . .	44
NIGHT ATTIRE . . . . .	46
MALE DRESS . . . . .	47—60
THE HEAD . . . . .	47
HAIR-GREASE, OIL, &c. . . . .	49
HATS . . . . .	50
NIGHT-CAPS . . . . .	55
THE NECK . . . . .	55
THE TRUNK AND EXTREMITIES . . . . .	57
OUTER GARMENTS . . . . .	57
BRACES AND BELTS. . . . .	59

FEMALE DRESS . . . . .	60—93
THE HEAD . . . . .	60
FALSE HAIR . . . . .	62
BONNETS . . . . .	62
VEILS . . . . .	63
THE NECK . . . . .	63
THE TRUNK AND EXTREMITIES . . . . .	64
UNDERCLOTHING . . . . .	65
THE LOW-NECKED DRESS . . . . .	66
PETTICOATS . . . . .	69
TIGHT SLEEVES . . . . .	71
TIGHT LACING . . . . .	72—89
ITS EFFECTS ON:—	
1. THE VISCERA . . . . .	81
2. THE RESPIRATION . . . . .	85
3. THE CIRCULATION . . . . .	86
4. THE MUSCULAR SYSTEM OF THE TRUNK . . . . .	86
5. THE GENERAL OUTLINE OF THE BODY . . . . .	88
A HYGIENIC COSTUME . . . . .	89
THE DIVIDED SKIRT . . . . .	90
THE HANDS . . . . .	93
THE FEET . . . . .	94—107
STOCKINGS AND SOCKS . . . . .	95
BOOTS AND SHOES . . . . .	96
SABOTS . . . . .	102
HIGH HEELS . . . . .	104
BOOTS <i>versus</i> SHOES . . . . .	106
THE DRESS OF INFANCY AND CHILDHOOD . . . . .	108—112
WARMTH . . . . .	108
DISTRIBUTION OF CLOTHING . . . . .	109
CONSTRICTION AND ITS EFFECTS . . . . .	110
THE WAIST . . . . .	112
QUANTITY AND WEIGHT OF CLOTHING . . . . .	112

# THE INFLUENCE OF CLOTHING ON HEALTH.



## INTRODUCTORY.

PROFOUND and manifold are the interests that centre around the exclusively human property of clothes-wearing. These interests depend for their importance not so much upon their number or their variety as upon their intensely personal character. There is, as Thomas Carlyle has shown, a Philosophy of Clothes ; and probably there is no branch of philosophy that is better understood, or that is more acceptable to the every-day world of men and women, than is this phase of the thinker's science. It may be no exaggeration to say that there are some to whom dress presents an interest that transcends all other interests. It may require no long journey through the world to meet with the spectacle of a woman gloating over some gorgeous novelty in apparel with the rapt devotion of a fetish-worshipper ; or the spectacle of a man who will devote some hours of intense cogitation to the proper selection and arrangement of a neck-tie. There are, it would appear, few great interests left unconcerned in this matter of clothes. Dress has a practical as well as a theoretical concern in morality. It assumes a by no means unimportant place in the science of society. It is of much consequence in all those studies of mankind that regard him from his stand-point as a gregarious animal. It has, moreover, an æsthetic aspect, a concern in the science of

ornament, and a part in the elaboration of what is vaguely known as taste. Especially must be noted those remarkable attributes of clothing that are concerned in a study of ceremonial dress. And lastly, and with no attempt to complete the list, there are interests in dress that are not dimly associated with the details of pride, vain-glory, and hypocrisy.

Now, this present chapter is concerned with but *one* aspect of the dress matter, with but one single feature in the "Clothes Philosophy"—the influence of dress on health. It must at once be confessed that it is not the aspect of the question that excites the greatest amount of interest among men and women. In criticising any article of dress, the points that, as a rule, first claim attention have reference to the beauty and attractiveness of the garment, its costliness, the opportunity it affords for display, and its suitableness to the individual who wears it. When all these points have been passed in review and disposed of, the question of health may possibly be entertained, and the hygienic influence of clothes taken into consideration. It would require but little argument to show that there are no interests involved in this matter of dress which are more important than are those that concern the health of the individual. The importance of these interests is to be measured only by the importance of human life, and by the value that attaches to the state of perfect health. And yet, as the world goes, these matters seem to be the least important elements in the criticism of dress. It would appear strange indeed if in the newspaper description of some conspicuous bridal costume attention should first be given to the hygienic aspects of the dress, and a minor importance attached to its costliness, its grandeur, and its marvellous ornamentation. Nevertheless, a bride, I presume, affords no exception to the common impression, that perfect health is more desirable than attractiveness. This anomalous condition of

things is readily explained on the simplest study of human nature. Health—if one might propound a paradox—is only noticed when it is absent. It is to those who are diseased that hygiene presents its greatest attractions, and, as the majority of the active members of society are to be classed with the healthy, it is a matter of no surprise that the hygienic relations of dress excite but scanty interest. Dress has, indeed, many positive attractions, while its health relationship must pose as a negative allurements.

These few preliminary remarks appear necessary, since the present chapter deals solely with but this one aspect of dress, and there are always difficulties and pitfalls in the way of a study of one especial attribute of a matter. These difficulties assume in the main a twofold character: the tendency to exalt the special subject to a spurious and exaggerated position, on the one hand; and the difficulty, on the other, of discussing it apart from the perhaps more potent influences that surround it. In the first place, those who would consider dress *solely* from a hygienic stand-point, and who would permit no influences to act in the selecting and fashioning of attire other than the rigid laws of health supplied, would rob dress of its most valued attractions. They would render it expressionless, and, to a multitude of people, almost purposeless. To them a garment of monastic simplicity would serve both for the apparel of every day and for the costume of State occasions. They would annihilate Fashion, and substitute a form in dress that would vie in monotony with the familiar attire of the human occupants of a child's Noah's ark.

The second difficulty is not the less important, in that it involves a perfectly different state of things, and is, perhaps, the one most active in the present instance. To consider the matter of the influence of dress upon health fully and entirely, it must be discussed without prejudice,

and without being unduly affected by those many attractions that attach themselves to the subject. Thus, to properly deal with the matter, one must commence its consideration free from many forms of bias : free from the bias that in the selection of dress beauty transcends all things, free from the bias that dress is but a vehicle for display, and free from the bias that public admiration is the sole criterion of its value. This object, I think, can be best attained by accepting, partly as a confession and partly as a kind of creed, an utterance of Herr Teufelsdröckh's that may well form a prelude to the entire matter :—"I—good Heaven !—have thatched myself over with the dead fleeces of sheep, the bark of vegetables, the entrails of worms, the hides of oxen or seals, the felt of furred beasts, and walk abroad a moving rag-screen, overheaped with shreds and tatters raked from the charnel-house of Nature, where they would have rotted, to rot on me more slowly ! Day after day I must thatch myself anew : day after day this despicable thatch must lose some film of its thickness ; some film of it, frayed away by tear and wear, must be brushed off into the ash-pit, into the lay-stall, till, by degrees, the whole has been brushed thither, and I, the dust-making patent rag-grinder, get new material to grind down."\*

#### THE PRIMARY OBJECTS OF CLOTHING.

The primary objects of dress are, I imagine, first, to afford a general protection to the body ; and, secondly, to maintain it everywhere at a proper and equable temperature. To these two purposes must be added a third, for which, however, but a minor importance can be claimed : the purpose, namely, of dress to act as a vehicle for personal decoration and ornament. The first two of these objects express in a general manner the relations of dress to health ; the third

\* "Sartor Resartus," chap. viii.



concerns solely the decorative attributes of clothing. In all criticisms that are passed upon dress, from a hygienic or utilitarian point of view, these primary objects must be prominently put forth. They must form a standard by which various costumes and articles of apparel can be judged and compared ; and they should form the basis of our conception of that nebulous entity—a *perfect dress*. The perfect dress, so far as it can be described in general terms, should fulfil the following requirements. It should afford a proper protection to the body, and should preserve it in a proper degree of warmth. These ends should be effected without interference with any natural function, and without limitation of any natural movement. The material of the dress should be such as to exercise no injurious effects upon the parts of the body with which it is in contact. The costume, as a whole, should be in conformity, so far as the above requirements will allow, with the tastes and fashion of the time, and with the dictates of modesty. Lastly, the dress should be ornamented as the taste of the wearer directs, provided that such decoration does not distinctly oppose the conditions already mentioned. I think that a dress such as this may be fairly taken as a standard for comparison ; and in criticising any form of clothing, it may not be unreasonable to judge of its merits by the closeness with which it conforms to the above details.

One of the most important practical points in connection with this present subject concerns the matter of ornament in dress, and upon this subject a few preliminary remarks may not be out of place.

It is against dress in its decorative aspects that the principal crusades of the hygienists have been directed. In this matter, as in many others, it is difficult to avoid extremes of opinion. It must be confessed that those who advocate what they are pleased to term “dress reform” are apt to entirely ignore the fact that decoration may very

fairly be placed among the original purposes of clothing. In proposing their reform, they are apt to be influenced solely by scientific considerations of the laws of health, and with this influence strong in their minds, they have invented costumes of extreme hideousness, and of very limited adaptability. Certain of the advances in "dress reform" have, I think, led to the very dangerous idea that a healthy costume is of necessity an ugly costume, and that to follow in dress the dictates of health is to follow in fashion the dictates of frumpishness. Any form of dress that is the outcome *solely* of certain hygienic laws is likely, except by simple accident, to be unattractive, inasmuch as it ceases to be an expression of the inner life of men and women, and becomes but the visible embodiment of certain hard scientific facts. That it is possible to have a dress that is both healthy and attractive has been proved over and over again; and one has only to refer to the costumes of ancient Rome and ancient Greece to find examples of a dress that offended no law of health and no canon of beauty.

The other extreme is, however, still more to be deprecated—the extreme of judging dress from no other than an æsthetic point of view, and of regarding it solely upon its possibilities for ornamentation and display. This view of things is the more dangerous, in that it is the more popular, and the less conducive to man's general well-being.

Probably the truth lies in the mean between the two. I would say that dress may be made the means for adornment in a multitude of ways, and to no niggardly extent, so long as that adornment does not offend against the two great primary objects of clothing. It is not every one who would wish their daily costume to be of puritanical plainness; but if, on the other hand, they wish to make it a means for display, let that display be kept within the simple bounds of the laws of health. Such a demand is, I think, neither pedantic nor unreasonable, and its practical

realisation would tax but lightly the ingenuity and resources of those who profess to clothe the outer man.

### THE MATERIALS USED IN DRESS.

For the following brief account of the commoner materials used for clothing I am indebted to Ure's "Dictionary of Arts and Manufactures."

*Wool*.—The fleece of the sheep. The quality of the wool is improved by the domestic culture of the animal, and it also depends upon the part of the sheep from whence it is taken. The Angora, or Angola, wool is about the best variety, and almost equally well regarded are the fleeces of the Merino breed and the breed of Saxony. The length of the wool fibre is from three to eight inches; its width about  $\frac{1}{1000}$ th of an inch. The surface is seen under the microscope to be imbricated, as with scales. The finer and shorter wools are used for fine cloth; the longer and coarser kinds for "worsted pieces," "paplins," &c.

*Flannel*.—A plain woollen stuff of a rather open and slight fabric.

*Cashmere*.—A material made from the down of wool found about the roots of the hair of the Thibet goat. Imitation Cashmere is made in England and France, and is composed of various mixed materials.

*Kerseymere*.—A fine fabric, woven plain from the finest wools.

*Linsey Woolsey*.—A mixture of flax and wool woven into coarse cloth.

*Alpaca*.—The fleece of a genus of animals inhabiting South America, and including the llamas, alpacas, vicunas, &c. The fleece is longer than that of the sheep, averaging six inches. It is soft and strong, and is commonly made up with cotton or silk.

*Mohair*.—The hair of a goat inhabiting the mountains in the vicinity of Angora. It is used in the construction of many materials—*e.g.*, plush, braid, a form of Utrecht velvet, &c. It is also woven into a light cloth that is to a certain extent waterproof.

*Silk*.—The thread spun by the silkworm. Each filament measures about  $\frac{1}{6000}$ th of an inch in width. It forms the strongest and most tenacious of textile fabrics. A thread of it is three times stronger than a like thread of flax, and twice as strong as a like thread of hemp.

*Satin*.—A silk stuff, so woven and prepared as to present a smooth and polished surface.

## 14 THE INFLUENCE OF CLOTHING ON HEALTH.

*Velvet*.—A silk fabric. The “pile” is due to the insertion of short pieces of silk thread doubled under the weft, or cross threads. These stand upright so thickly as to entirely conceal the interlacings of the warp.

*Crape*.—A Bolognese invention. It is made of raw silk, gummed and twisted at the mill to form a gauze-like fabric.

*Taffety*.—A light silk fabric with a considerable gloss.

*Moire and Brocade*.—Ornamented silk fabrics.

*Plush*.—A kind of velvet, made of silk, or of cotton, or of silk and cotton. Sometimes made of goat's or camel's hair, or of wool.

*Cotton*.—A filamentous down which invests the seeds of the gossypium plant. The threads are ribbon-like and twisted, and measure from  $\frac{1}{8000}$ th to  $\frac{1}{3000}$ th of an inch in width.

*Calico*.—Cotton cloth. Is extensively printed.

*Fustian*.—A common twilled cotton cloth of a stout fabric, which receives no ornament in the loom, but is most frequently dyed after being woven.

*Jean*.—A twilled cotton, usually striped. Is sometimes made of silk.

*Velveteen*.—A cotton fabric, so woven as to imitate velvet.

*Muslin*.—A fine cotton fabric.

*Flax*.—The fibres of the flax plant, *Linum usitatissimum*.

*Linen*.—A cloth manufactured from flax.

*Cambric*.—A very fine and thin linen fabric, first made at Cambray. It is imitated in cotton.

*Lawn*.—A very fine linen material.

*Jute*.—The fibres of two plants, the *Corchorus olitorius* and *Corchorus capsularis*. It is used in the manufacture of certain coarse fabrics, and in the production of certain imitation goods.

## THE COMPARATIVE VALUE OF DRESS MATERIALS AS ARTICLES OF CLOTHING.

The qualities that may be considered under this head are very numerous, and appeal to many and varied interests. I propose to deal, however, only with such properties of clothing materials as concern, directly or indirectly, the matter of health. This limitation, although it considerably narrows the subject, by no means makes it of insignificant extent. It excludes numerous details that would probably

represent to many the most interesting features in connection with dress—such as, for example, the comparative costliness of materials used in clothing, their æsthetic properties, their adaptability for decoration, their suitability for certain individuals and for certain circumstances, *et hoc genus omne*.

In the following paragraphs the properties of certain dress materials will be discussed under these heads : 1. Warmth ; 2. Hygroscopic Properties, or the Property of Absorbing Moisture ; 3. Porosity ; 4. Impermeability to Water ; 5. Inflammability ; 6. Power of Absorbing Odours ; 7. Electrical Qualities ; and 8. Certain Poisonous Dyes.

1. *The "Warmth" of Clothing.*—It is a matter of the very commonest observation that certain garments are "warm," while others are described as being "cool." It is perhaps needless to say that articles of clothing possess neither warmth nor coldness in themselves. What is meant by a warm garment is one that is capable of retaining the natural heat of the body, while the cool garment, so called, allows that heat to escape, and brings the surface of the body more immediately under the influence of the cooler atmosphere that surrounds it.

To properly understand this matter of the warmth of clothing, it is needful to take some note of the facts and circumstances of animal heat.

By *animal heat* is meant the natural heat that is developed within the bodies of man and animals. This heat depends upon many complicated conditions. In great part it is the product of certain chemical processes that are perpetually active in the body, and that themselves are due to the continuous disintegration and building up of the animal organism. There are certain articles of food which figure especially as "heat producers," having indeed that sole function. There are certain tissues of the body itself

that are "heat producers," and among them may be mentioned the muscles, the liver, and the brain ; for activity in these various organs adds an increment of heat to the general temperature.

The average temperature of the external surface of the body is  $98.6^{\circ}$  Fahr. This temperature is subjected to certain but slight variations. Thus, the average temperature of the female is stated to be very slightly higher than that of the male. The temperature of infancy and old age is somewhat higher than that of adult life, although the powers of resisting cold at the two extremes of life are markedly less. The period of the day has some influence upon the warmth of the body, the minimum temperature being reached at night or in the early morning, the maximum late in the afternoon. These differences, however, do not extend beyond  $1^{\circ}$  to  $1\frac{1}{2}^{\circ}$  Fahr. Active exercise raises the temperature, but not more than  $1^{\circ}$  or at the most  $2^{\circ}$  Fahr. The sensation of heat after exercise may be great, but it is only a sensation. The heat of the body is the same in temperate and tropical climates, although the *sensations* of warmth experienced under the one climate may be more marked than those felt under the other. In like manner, the animal temperature in summer is never more than from  $\frac{1}{5}^{\circ}$  to  $\frac{1}{3}^{\circ}$  Fahr. above that in the winter.

The animal temperature must be *regulated* ; for the body would become unduly heated if means were not afforded for a constant loss of a certain amount of animal warmth. When the body heat has effected its purpose, it is necessary that it should be removed, and this is effected mainly through the action of the skin. It is especially important to note, in connection with the subject of clothes, that at least 70 per cent. of the whole amount of animal heat lost is lost through the integument. It is lost in three ways. Heat is *conducted* away from the surface of the body ; it *radiates* also from that surface ; and, in the third

place, a great deal of heat is lost by the *evaporation* of moisture from the same part.

The moisture is commonly known as perspiration, and it is important to bear in mind that the body at all times, and under all ordinary circumstances, is perspiring. When the weather is hot, the skin perspires more readily, additional material for evaporation is provided, and the body becomes more rapidly cool. In winter, however, the skin perspires but little, evaporation is inactive, and the loss of heat from the surface of the body is thus reduced to a minimum. After exercise, the body sweats, and the necessary cooling of the heated surface is effected by the evaporation of that moisture. It will be understood that the evaporation from the skin, if very rapid, may lead to too sudden cooling of the body. This would be illustrated by a man who, when perspiring after exercise, stands in a current of cool air. The process is then conducted with great rapidity, and the individual "catches a cold." Lastly, it may be noted that evaporation is much influenced by the amount of moisture in the air, and that the drier the air the more rapid the process.

It is now necessary to consider how clothes contribute to the warmth of the body, and what is meant by the "warmth" of clothing.

In the first place, those materials that are bad conductors of heat will the best maintain the body at an equable temperature. In cold weather their non-conducting properties do not permit the natural heat of the body to escape in any but the tardiest manner; and, on the other hand, in a very hot atmosphere they are slow to conduct to the skin the heat that is without.

Taking the ordinary materials used in dress, it will be found that, as bad conductors of heat, woollen textures rank first, and with them furs and down. Then come silk and cotton, while lastly, as the best conductor, comes flax, the material of which linen is made. Thus, then, the greatest

amount of "warmth" will be derived from furs and woollen goods, and the least amount from linen—facts that are matters of every-day experience.

Many experiments have been made from time to time to estimate the *comparative* conducting powers of these various materials, and not among the least interesting of these observations are those recorded by Count Rumford in the "Philosophical Transactions," as long ago as 1792. As a result of these and of other researches, it may be said that if the conducting power of linen be represented by 100, then the conducting power of wool would be from 50 to 70. Thus, speaking solely of this matter of conduction, wool has twice the "warmth," as an article of clothing, that linen possesses. Between calico and linen there is not so great a difference, and that difference, such as it is, is expressed by the following experiment. Observations were made as to the comparative time of cooling of certain materials that had been heated to a given heat. It was found that while the time of cooling of linen was represented by  $10\frac{1}{2}$  minutes, that of calico was  $11\frac{1}{2}$  minutes.\*

These remarks so far refer only to the material of dress, and it is now necessary to consider *the influence of colour upon the "warmth" of clothing*—a subject of considerable interest.

Colour makes very little difference with regard to heat radiated from the body. The colour of underclothing, considered solely from the stand-point of warmth, is a matter practically of no moment. It makes little or no difference if the garment worn next to the skin is red or blue or black, so long as it is of a material that will, as a bad heat conductor, maintain for the body a proper temperature. With regard, however, to heat that acts upon the body from without, colour involves a considerable difference. As the chief example of this kind of heat, the heat from the

\* "Étude sur les vêtements chez l'homme et chez la femme dans leurs rapports avec l'hygiène." J. Cerviotti, Paris, 1871.



sun may be taken. Experiments made upon this point show that the same material will absorb very different amounts of heat when dyed with different colours. The greatest amount of heat is absorbed by black, and the least amount by white.

The influence of colour upon the absorption of heat is shown by the following table,\* which records the amount of heat absorbed in a given time by "shirting" of the same quality dyed with the various colours mentioned.

When white received	.	.	.	.	100° Fahr.
Pale straw received	.	.	.	.	102° „
Dark yellow „	.	.	.	.	140° „
Light green „	.	.	.	.	155° „
Turkey red „	.	.	.	.	165° „
Dark green „	.	.	.	.	168° „
Light blue „	.	.	.	.	198° „
Black „	.	.	.	.	208° „

Dark blue, it may be added, absorbs almost as much as black.

Some interesting experiments that bear directly upon this subject were carried out in the Soudan by the correspondent of the *Lancet*. Ten tin boxes painted as below were exposed for two hours to the action of the sun. A thermometer had been introduced into each of the boxes, and the opening closed. The instruments, when examined, showed the following variations :—

1. White . . . . .	100° Fahr.	6. French grey . . . . .	106½° Fahr.
2. Stone colour . . . . .	102½° „	7. Lead colour . . . . .	109° „
3. Yellow . . . . .	103½° „	8. Light green . . . . .	109° „
4. Red . . . . .	104° „	9. Dark green . . . . .	110½° „
5. Blue. . . . .	106° „	10. Black . . . . .	114° „

An interesting demonstration of the different powers of

\* "A Treatise on Hygiene and Public Health," by N. Buck, London, 1879. See also "Influence de la couleur sur le calorique" (*Annales d'hygiène*," 1er série, t. xii. p. 54).

absorbing heat possessed by deeply coloured materials on the one hand, and those that are simply white on the other, is afforded by the following experiment. Put a fragment of the common willow-pattern plate into a bright fire, and allow it to become heated to redness. Then remove it with tongs, and hold it up in a dark room, when the pattern will glow *white* upon a dark ground. This simply demonstrates that the dark colour of the pattern first absorbs and then gives off more heat than the white ground. A more direct and personal illustration of these facts, however, is afforded by common experience. The laws of the influence of colour upon heat underlie the selection of white and brightly coloured materials for summer wear, and the use of the more sombre tints for the cold days of winter. The brilliant colours of the tropics, and the less vivid tints that pervade the cooler zones, bear without doubt upon this same interaction between colour and heat. Many other facts illustrate the same relationship. By a very accurate experience the sailor wears a white jacket in the summer, and a deep-blue coloured material in the winter. Cricket is an out-door game played in the summer, and it is not a little significant that ancient custom has established that white shall be the colour of cricketing apparel, while football, a winter game, presents us with individuals clad in a multitude of colours, of which the majority tend towards the deeper shades.

Another point to be considered in connection with the warmth of clothing is its influence upon the *evaporation* from the skin.

It has been already stated that the body is cooled—among other ways—by the constant evaporation of moisture from its surface. It is obvious, therefore, that any material used for dress that interferes with this evaporation must be considered as possessing qualities of warmth. This matter of the relation of clothing to the evaporation of body-

moisture will be dealt with in greater detail subsequently. It will be sufficient in the present place to say that this relation depends mainly upon the power of the material for absorbing moisture on the one hand, and the impermeability of the fabric on the other.

Certain materials used for dress absorb the moisture from the skin with rapidity, and passing this moisture on, as it were, allow it to evaporate from the surface. Such fabrics would tend to expedite the natural cooling of the body, and would be termed "cool" materials. Impermeable fabrics, on the other hand, will not allow of the escape of the perspiration. They keep the air that is in immediate contact with the skin saturated with moisture. Evaporation becomes more and more difficult; and if a garment impermeable to moisture is long worn, it will cause a profuse sweating of the skin. It is for these reasons that macintosh garments are considered hot; and it is well known that even moderate exercise in a waterproof coat or cloak is apt to induce a free perspiration. The warmth, so called, of a macintosh does not depend—as does the warmth of the fabrics above discussed—upon its power of conducting heat, but mainly upon the effect it has upon the action of the skin. Macintosh is, indeed, a fair conductor of heat, and would be a cool material for dress if only it were permeable enough to allow of the escape of moisture. It is, perhaps, needless to say that the bodily heat encouraged and developed by macintosh and like impermeable materials is not a healthy form of heat, inasmuch as it depends in the main upon an interference with one of the natural and most important functions of the organism.

One more point remains to be considered in connection with this subject of the comparative warmth of dress. It refers to the property certain fabrics possess of *irritating or stimulating the skin*. If the skin be irritated, as by friction against a rough surface, the blood-vessels are encouraged to

dilate; an additional amount of blood is thus brought to the part, and a sensation of increased warmth is experienced. Within certain reservations, it may be said that, other things being equal, a material with a rough surface will feel warmer than the same material with a smooth surface. It will be a matter, I presume, of general experience, that a rough woollen vest worn next to the skin will produce a greater sense of warmth than will a vest of like material but of smooth texture. The rough woollen material presents, projecting from its surface, millions of little irregular hairs and fibres, that from as many points gently irritate the skin, and produce the effect which has just been mentioned. The degree of this irritation will depend upon many circumstances; in the first place, upon the susceptibility of the individual and the sensitiveness of his skin. There are some persons who cannot wear flannel or woollen materials as underclothing, because they produce upon an unduly sensitive integument so much irritation, and such a disagreeable sense of warmth, that their use cannot be persevered with. There are others who are conscious of but little difference between a rough under-garment and a smooth, and to such the additional warmth afforded by the skin stimulation is inconsiderable, or not to be appreciated.

In the second place, it must be remembered that the body tends to accommodate itself to a variety of circumstances. The rough garment may irritate the skin at first, but after awhile the integument becomes accustomed to the stimulation, and in time ceases to respond to it. The rough material has then become as little of an irritant as is the smooth, and any additional warmth that that irritant once involved is no longer felt.

The comparative warmth of tight or loose fitting garments, and other points incident to the subject, will be dealt with in a subsequent paragraph.

## 2. *The Hygroscopic Properties of Clothing Materials.*—

By hygroscopy is meant the property of certain substances for absorbing moisture. The materials that are used in dress absorb moisture in very different degrees, and they are thus said to possess different hygroscopic qualities.

This property is of much importance in the hygiene of clothing. The advantages of materials that absorb moisture readily are these:—When an individual perspires freely, the garment promptly takes up the watery matter and diffuses it through its meshes. The water so absorbed by the garment undergoes, of course, evaporation; but the cooling effect of that evaporation is removed from the skin, where it might prove harmful, to the dress material, where it is comparatively harmless. Moreover, the moisture being thus removed upon the surface of the body, less is left in contact with the skin, and therefore the effects of evaporation upon that part are greatly lessened. A material that has feeble hygroscopic properties, when worn next to a perspiring skin, simply gets wetted. It does not remove the moisture from contact with the skin by taking it into its substance, but allows it to remain upon its surface, and proves a source for further cooling of the body. In noting the evil effects of damp clothes, it must be remembered that water is a better conductor of heat than air, and that, other considerations apart, a wet material removes the vital warmth much more quickly than does a dry fabric, the meshes of which are occupied simply with air.

The following table\* will show the comparative value of certain dress materials with reference to the hygroscopic property. Each substance experimented upon was first weighed after it had been dried in a hot chamber for twenty-four hours. For purposes of subsequent comparison,

\* See *Brit. and Foreign Med. Chir. Review*, vol. ii. 1859, p. 371.

it was arranged that each substance should start at the same weight (column No. 1). The materials made use of were then weighed again after they had been exposed for forty-eight hours in a cold uninhabited room (results given under column No. 2) ; and, lastly, they were again weighed after an exposure of seventy-two hours in a damp cellar (results given under column No. 3).

	No. 1. Weight.	No. 2. Weight.	No. 3. Weight.
Sheep's-wool . . .	1,000	1,084	1,163
Fur . . . . .	1,000	1,072	1,125
Eider-down . . .	1,000	1,067	1,112
Silk . . . . .	1,000	1,057	1,107
Linen . . . . .	1,000	1,046	1,102
Cotton . . . . .	1,000	1,043	1,089

Pettenkofer, adopting a different mode of investigation, estimated that the maximum hygroscopic properties of wool (flannel) were represented by 174, and the minimum by 111 ; while with linen the maximum was represented by 75, the minimum by 41.

Thus it will be seen that the greatest powers of absorbing moisture are possessed by wool, fur, and down, while the least amount of moisture is taken up by cotton. Linen is a little more hygroscopic than cotton, and silk is a good deal more potent in that direction. It cannot fail to be observed that this order very closely resembles that given when dealing with the warmth of clothing materials considered with reference to their powers of conducting heat.

The practical outcome of these facts teaches us that an individual who is perspiring freely is much less likely to catch cold when clad in flannel than when clad in linen. This especially applies to those who, while indulging in violent exercise, are exposed to changes of temperature or currents of air.

Flannel is the material very generally assumed by those who take vigorous exercise in the open air; it is the material, as a rule, adopted by the miner, who works in a cold or fluctuating temperature, and whose body is apt to perspire freely while in that atmosphere; and it is, indeed, a popular—perhaps the most popular—fabric for underclothing made use of by the labourer in the fields, as well as by the worker in the heated factory.

There is another matter in connection with this question of the hygroscopic properties of dress fabrics which must be mentioned, because it shows that the possession of this property is not an unmixed advantage. The disadvantage, I must confess, is very trifling, and its insignificance is the more marked when compared with the benefits that attend a hygroscopic material for these purposes. When a substance absorbs moisture, it of necessity increases in *weight*. That this increase in weight is not slight is shown by the above table, where it will be seen that the weight of a woollen material may be increased from 1,000 units to 1,163 by simply exposing it for some time in a damp cellar. It is desirable, for many reasons, that articles of clothing should be as light as possible, and it will be noted that the possession of good hygroscopic qualities somewhat interferes with this end. If an individual wearing woollen clothing of any kind (which we will assume is quite dry) were to occupy for some time a damp room, the air of which was charged with moisture, he would leave that room with more than 10 per cent. added to the weight of all the woollen garments he might be wearing. It is a matter deserving of note, although not one of great moment. When clothes, however, become actually *wet*, the increase in weight that woollen materials undergo is really considerable, and may even cause some inconvenience. Those who are interested in this matter should weigh a thick “Ulster” overcoat when quite dry, and again when quite wet, and

the difference in weight will be found to be no trifling matter. These facts point to the unsuitableness of woollen fabrics when protection against actual wet and rain is required. Woollen garments afford excellent protection against cold and against changes of climate, but they are not suitable for those purposes for which "waterproofs" are usually worn. A long walk in the rain, clad in a macintosh, will be attended with disadvantages, but these disadvantages are outweighed by the discomfort of a wet journey in a thick "Ulster."

3. *Porosity*.—By the porosity of clothing is understood the ease with which air is driven through the material experimented upon. This point has a practical bearing upon the "ventilating" properties possessed by certain dress fabrics, and their power of resisting the penetration of wind. The following table \* shows comparatively the amount of air driven through certain materials during a given time and under a given pressure :—

Through Flannel . . . .	10·41 measures.
„ Lambskin . . . .	6·07 „
„ Linen . . . .	6·03 „
„ Washleather . . . .	5·37 „
„ Silk Fabric . . . .	4·14 „
„ Glove Leather . . . .	·15 „

This result corresponds with Pettenkofer's statement, that flannel is more permeable to air than linen, in the proportion of 100 to 58. Thus it will be observed that the warmest clothing (flannel) may be the most porous.

4. *Impermeability to Water*.—Some of the points that may justly come under this heading have been already considered when dealing with the hygroscopic properties of clothing. I propose, however, to consider the impermeability

\* Parkes' "Manual of Practical Hygiene," 5th ed. London, 1878, p. 420.



of certain dress materials in the light of their capacity to act as *waterproofs*.

A textile fabric of almost any kind may be rendered waterproof by one or other of the following substances :—

*a.* Linseed oil, to which a drying quality has been communicated by boiling with litharge or sugar of lead.

*b.* The same oil holding in solution a little caoutchouc.

*c.* A varnish made by dissolving caoutchouc in rectified petroleum or naphtha, applied between two surfaces of cloth (Macintosh's patent).

*d.* A solution of caoutchouc applied to one side only of a single-texture fabric.

*e.* A solution of soap worked into cloth, and decomposed in it by the action of a solution of alum, whence results a mixture of acid, fats, and alumina, which insinuates itself among all the woolly filaments, fills their interstices, and prevents the passage of water.

*f.* A solution of glue or isinglass, introduced into a stuff, and then acted upon by a clear infusion of galls, whereby the fibres get impregnated with an insoluble, impermeable, pulverulent leather.\*

To these may perhaps be added the ancient and simple waterproof made by applying hot pitch or tar to the surface of some strong and open-meshed fabric. These processes are of different values for rendering materials impermeable to water. The two first-mentioned are but little used now for rendering waterproof articles of apparel, although they are still used for other purposes. Of the other methods, it can only be said that the most perfect waterproof is that manufactured with indiarubber, or caoutchouc. The

\* Ure's "Dictionary of Art Manufactures and Mines," London, 1860, vol. 2.

material so prepared is as impermeable to water or to moisture as is a piece of porcelain. It has the advantage, moreover, of being light and supple, and is capable of being adapted to a multitude of purposes. If it be simply desired to have a garment that will keep out wet and rain, then it must be owned that the macintosh leaves nothing to be desired.

It will be noticed that there are two principal methods of making a fabric waterproof by means of caoutchouc. By one method the indiarubber solution is applied to one side only of a single fabric ; by the other it is applied between two layers of the material used. The first plan is represented by the ordinary "macintosh," the second by what is commonly known as "macintosh cloth," the names in each instance being derived from that of the well-known firm of manufacturers. Materials prepared by either of these methods are equally impervious to water, but the first-named method has certain decided advantages when applied to wearing apparel. The "macintosh cloth" can imbibe water by means of its outer layer of cloth. Thus when wet its weight is considerably increased ; it takes some time to dry, and the evaporation from its surface produces a certain unnecessary degree of cold. The simple macintosh, on the other hand, can imbibe no moisture ; the heaviest rainstorm will not add to its weight, and it requires no drying after wear. Its only disadvantage, perhaps, is in the matter of appearance.

As has been already stated, all "waterproofs" present this serious evil—that while they keep out all external moisture, they do not permit of the escape of the natural moisture from the surface of the body. Thus, if long worn, they produce a sense of unpleasant warmth and a feeling of oppression, while, by interfering with the process of evaporation, they allow a large quantity of perspiration to accumulate on the skin. The waterproof usually worn by

ladies does allow in some degree of the escape of moisture from the body, but it is not impermeable to rain if tested in a severe shower. The great need is a waterproof garment so constructed that there shall be an opportunity for the escape of the moisture from the skin while its efficacy as a waterproof is unimpaired. It will be necessary to return to this subject when dealing with clothing in relation to times and seasons.

Silk and cotton fabrics become wet through sooner than do woollen materials of equal thickness, owing to the less amount of moisture that the former are capable of absorbing. They are soon saturated, and their protective powers against rain are consequently very limited. Fur acts, up to a certain time, as a good protection against external moisture. Its physical properties are such that for awhile it keeps the rain-drops on its surface. Soon, however, the fibres of the fur become matted together, the water runs along them by capillary attraction, and it becomes saturated in about the same time that would be required for the saturation of an equal quantity of wool.

5. *Inflammability*.—In judging the comparative values of certain fabrics as articles of dress, it is important to consider the inflammability of those textures. This is especially important to those who are engaged in employments that render frequent contact with burning matters unavoidable, or that involve more than the usual risks of conflagration. Men so employed can usually form some rough estimate of the probabilities of their clothes being set on fire, and consequently take precautions in accordance with those probabilities. The well-known property of woollen fabrics to smoulder, rather than to break out into flame, when set on fire, renders their use very common with men following these occupations. The resistance that stout leather offers when in momentary contact with burning

matters is also well known, and makes the use of leather very general in factories and arsenals where fire forms an essential feature in the works. A woollen shirt and woollen cloth trousers, covered as far as possible by a good leather apron, form the usual attire of those who work extensively with fire, and it must be confessed that a better costume for all ordinary purposes is not to be desired.

Accidents from fire, however, are unfortunately not limited to iron-works and forges, and it is needful therefore to form some estimate of the comparative inflammability of the common materials of dress. All dress fabrics will burn when set on fire ; but some, while being consumed under an ordinary heat, will simply smoulder ; while others will break out into flame. It is, of course, with these latter that the great danger lies. They burst into flame, and consume rapidly ; the flames soon reach exposed parts of the body, and it is possible that an individual clad with such fabrics may be burnt to death in the space of some few minutes. Materials that smoulder are obviously much less dangerous. They consume slowly, and allow time for means to be taken to extinguish the fire. The absence of flame, moreover, limits the burning to one spot, and prevents the simultaneous setting alight of other portions of the dress.

The following experiments serve to demonstrate the comparative inflammability of the common dress fabrics—wool, silk, cotton, and linen. A piece of each of these materials in a woven state is taken, placed upon a support of platinum foil, and held over a flame. Under these conditions the wool and silk will become charred without bursting out into flame, while the cotton and linen fabrics will burst into flame and be rapidly consumed. Then, again, thin strips of these substances are taken and are wound round a copper wire. The end of the strip of material is ignited at a flame, as a taper would be

ignited. As a result it will be seen that the cotton and linen fabrics will burst into flame and will burn to the end, the flame coiling round the wire. With regard, however, to the silken and woollen materials, they can hardly be made to flame, and when flame forms it soon goes out, and unless re-ignited the strips will not burn to the end. From these and like experiments it becomes evident that, of the common dress materials, cotton is the most inflammable; then follows linen, which burns with almost equal readiness; next in order, but at a very appreciable distance, comes silk; and last of all wool.

Wool, then, of all these substances, is the least inflammable, and should afford the best protection against accidents from fire. It is well to observe, also, that the density with which any given fabric is woven adds to its power of resisting the rapid action of fire. A closely woven woollen cloth will offer a better resistance to flame than will an open-meshed fabric made of a like material. In like manner, the more loose the weaving of a cotton fabric, the more complete and rapid is its surrender to the action of flame. It thus follows, then, that of all common dress materials, muslin is the most inflammable. It is made of fine cotton thread, and is of the most open possible texture, and it is to muslin that so many cases of severe and fatal burnings must be ascribed. The inflammability of dress materials is a matter that more closely concerns women than men. In the first place, the arrangement of the female dress is such that it is much more liable to the ordinary accidents from fire than is the less ample costume of men; and in the second place, the outer garments worn by men are usually made of cloth containing more or less wool, while women are often clad in dresses composed, in whole or in part, of the more inflammable fabrics. An ample muslin dress heads the list of dangerous articles of clothing, if we have special reference to this matter of

inflammability ; and when the dimensions of such a dress are increased by a large crinoline (as was the fashion once), it becomes simply an "infernally machine," and should be avoided with the care with which one would avoid a bomb of dynamite. During the period of time that crinolines were fashionable, the number of deaths from burning among females was simply terrible ; for the crinoline not only involves an additional amount of the inflammable material, but it also aids the rapidity with which it burns by bringing it more completely in contact with the air. It must be observed, also, that all trimmings, especially when made of the more inflammable fabrics, add to the risk of the garment being set alight, and this applies more particularly to such trimmings as project from the surface of the dress and so add to the points that may come in contact with unguarded flame. Among the poorer classes the common cotton dress is a frequent source of serious accident, owing to the readiness with which it takes fire, and this end is very often brought about through the medium of a cotton apron. Among the less wealthy orders, children are, perhaps, more frequently the victims of severe burns than are those who are grown up. The circumstance is not difficult to understand if one considers the peculiar tendencies and surroundings of children, and especially of neglected children. The garment that of all others brings about these unfortunate accidents is, so far as my experience of burns in hospital practice is concerned, a long cotton pinafore. A child tries to reach some forbidden object from the mantelpiece, or to peer into some culinary details, the pinafore hangs down in front of the fire, the draught carries its lower end against the bars, and it is promptly set alight.

Apart from this question of inflammability, it is well to note the protection afforded by certain dress fabrics when the body is exposed to intense artificial heat. The protec-

tion in such a case depends upon the value of the material as a bad conductor of heat ; and the power, therefore, that certain fabrics possess of affording this protection depends upon their non-conducting properties. It is needless to say that woollen fabrics are the most valuable for this purpose, and the use of such fabrics to modify the evils of great heat is well known. The kettle-holder owes its efficacy mainly to the amount of wool it contains ; and a woollen " holder " will better carry out its especial purpose than would one made of linen, even if it contained twice the amount of material. The protection thus afforded by woollen stuffs was well illustrated in the surgical report on a certain fatal accident in America a few years ago.\* It appears that an excursion train came into collision with another train, the engine of which was actually thrust, or " telescoped," into one of the excursion carriages. One of the external pipes of the engine was broken by the collision, and an immense volume of intensely heated steam was poured forthwith into the car. A number of people were thus scalded to death before their escape could be effected, and an examination of the bodies, both of those who had died and those who survived, revealed some striking facts. The weather being warm, the holiday party were lightly clad, and many of the women were clothed in the thinnest muslin dresses. These fared the worst of the whole party, and few so clad escaped with their lives. The extent of surface scalded, and the depth of the scald, depended mainly upon the nature of the underclothing worn. One or two of the occupants of the car wore woollen materials next to the skin, and these individuals were only scalded in such parts as were not so clad. The wool, indeed, had afforded a perfect protection. The least amount of scalding of the skin was found in those who were fortunate enough to have outer garments made of cloth containing

\* *American Journal of Medical Sciences.* 1881.

more or less of this non-conducting material. The worst cases of scalding were afforded by those whose attire consisted solely of cotton or linen fabrics—fabrics possessing the unfortunate property (in this instance, at least) of being good conductors of heat.

Before concluding this subject, attention must be directed to non-inflammable dress fabrics, or rather to the means adopted to render ordinary dress materials non-inflammable. These measures have been applied for the most part to muslin, as being the most dangerous dress material coming under the present category. As muslin is not only very ready to catch alight, but is also very commonly used under circumstances that favour accidents from fire, a non-inflammable muslin has justly been considered as a desirable object. To render this or other like fabrics non-inflammable, certain chemicals are used, and with these chemicals the material is saturated. It is necessary that the chemicals used should in no way affect the colour of the muslin, that they should not prove destructive to its fibres, that they should remain unaltered during ironing, and that they should be non-poisonous. It will be seen that these requirements—which are neither few nor trifling—will seriously limit the number of the materials that may be capable of rendering a dress fabric non-inflammable.

The following are the chief salts that have been used in the production of non-inflammable garments, the material selected being, as a rule, muslin :—

- a.* Phosphate of ammonia.
- b.* A mixture of phosphate of ammonia and chloride of ammonia.
- c.* Sulphate of ammonia.
- d.* Tungstate of soda.

The objection to the first-named of these—the phosphate of ammonia—is that it gives to the muslin a somewhat



chalky "finish," and for other reasons the salt is but little used. The sulphate of ammonia has the advantage of being the cheapest of the materials used for this purpose, and muslin dipped into a 10 per cent. solution of this salt, and then dried, is rendered quite non-inflammable. It is said, however, to interfere with certain colours, especially with madder purple. The best of all materials in the above list, however, is the tungstate of soda, for it possesses the property of being unaffected by ironing. All the other salts that have been mentioned are unable to stand the ironing process, and are therefore of very limited value. The majority, therefore, of non-inflammable muslins owe their properties to this little-known compound, tungstate of soda.

There are certain disadvantages in the use of these salts, the chief of which are these: By the use of any of the above-named solutions the weight of the muslin is increased from 18 to 26 per cent.; and as the salts are all soluble in water, they immediately wash out when under the hands of the laundress, and therefore the chemical treatment has to be repeated every time that the material is washed. To somewhat meet this latter difficulty, a "fire-proof starch," prepared with tungstate of soda, was introduced some years ago by Mr. Donald Nicoll. This starch, if used in the ordinary way, would render the fabric non-inflammable.\*

A solution of molybdate of soda has been used for rendering non-inflammable the garments of workmen in arsenals, but I am unable to find any detailed account of its efficacy.†

It must not be supposed that these or any other chemicals prevent the fabric heated from being consumed if exposed to fire. They prevent it from breaking out into

\* See *Lancet*, vol. i., p. 875; 1872.

† See *Lancet*, vol. ii., p. 544; 1867.

flame; and if a piece of "non-inflammable muslin" is set on fire it simply crumbles away in a manner that is comparatively innocuous.

The only "cloth" that is absolutely unaffected by fire is "asbestos cloth." A coat made of this substance would merely be cleaned and improved by being occasionally placed in a furnace. Asbestos cloth, however, is rather a curiosity than a material for dress, although history informs us of several famous asbestos coats and cloaks. Probably the only specimens of this fabric will be found in museums and in the cabinets of the curious.

6. *Absorption of odours.*—"This partly depends on colour; and Stark's observations show that the power of absorption is in this order—black, blue, red, green, yellow, white. So far as texture is concerned, the absorption is in proportion to the hygroscopic absorption; and wool therefore absorbs more than cotton or linen." \*

7. *Electrical qualities.*—There is little to be said under this heading. It is well known that certain materials are better conductors of electricity than are others. Thus, as regards the commoner materials for dress, silk presents itself as a very bad conductor; and then in order of decrease come wool, flax, and cotton. With reference to certain other electrical qualities, Cerviotti places dress materials in two categories. (1) Idio-electric substances, or substances that are able to retain "animal" electricity—*e.g.*, silks, skins, &c. (2) Anelectric substances, represented by those that are able to disengage electricity by their friction, and to prevent its accumulation—*e.g.*, wool, linen, cotton.

8. *Certain poisonous dyes.*—Certain dress fabrics are obnoxious, in that they are coloured with poisonous dyes.

\* Parkes, loc. cit.

The poisonous agent is usually arsenic, and the colours containing this agent are for the most part bright reds, magentas, aniline reds, and certain greens.

### UNDERCLOTHING.

I now propose to consider the question of underclothing in its general features, reserving certain special details for further treatment.

*Wool.*—Without doubt wool is the best material for all kinds of underclothing, and there are very few circumstances under which wool is not the best material to be worn next to the skin. Upon these two points there is a remarkable uniformity of opinion among those who have the most fully considered the details of personal hygiene. The great value of woollen fabrics for underclothing, and especially for such clothing as comes in contact with the skin, will no doubt be understood from what has been already said. In cold weather woollen underclothing owes its so-called warmth to its remarkably poor conducting properties. These properties allow it to maintain the natural temperature of the body by preventing the heat of the body from being conducted away from the surface. It prevents, indeed, any loss of natural warmth. Linen and cotton materials, on the other hand, being comparatively good conductors of heat, allow the warmth of the body to be conducted away from the surface, and by the loss of this warmth the surface becomes cooled. In hot weather, the poor conducting properties of wool are valuable in another way. It fails to conduct to the body the additional heat in the external atmosphere. It may be truly said to protect the organism from the heat by virtue of these non-conducting qualities. Cotton and linen, on the

other hand, readily conduct to the skin the heat that is without, they serve as but the feeblest protection from that heat, and allow the body to be rapidly influenced by the condition of the external atmosphere. The great value of woollen underclothing, however, is shown by the manner in which it prevents or modifies the evil effects of rapid changes of temperature. In this country, at least, the climate is liable to certain abrupt fluctuations. A warm day succeeds a cool, and a cool a warm, with little notice or warning. The temperature that during the day has been high, may fall suddenly towards sunset, and a chilly evening succeed a blazing noon. It is needless, moreover, to say that like fluctuations of temperature occur at certain times and seasons all over the world.

A good illustration of the changes of temperature to which the body may be subjected in a brief interval may be found on any warm day of early summer when a strong north or easterly wind is blowing. On such a day an individual sitting in the full blaze of the sun, and well sheltered from the wind, may feel positively "hot"; while another, equally well protected from the wind, but sheltered also from the sun, may feel but comfortably warm; a third exposed to the full blast of the wind, to the rapid passage over the body of a colder air, may reasonably complain of being chilled. Now it so happens that the disorders that depend upon what is known as catching cold depend for the most part upon sudden changes of temperature. "These disorders," says an authority, "are induced by the removal of heat to an unusual extent from the external or internal surface of the body."\* The same writer recognises three factors in the probable cause of a "cold"—a low temperature, air in motion, and moisture; and I think that common experience teaches us—*à propos* of these factors—that colds

\* Seitz. Ziemssen's "Cyclopædia of Medicine," vol. xvi., p. 232. 1877.

are most frequent when the weather is cold and windy and wet. Now, against these evils of sudden change woollen under-garments afford a trustworthy protection. They isolate the body. They prevent it from being influenced by the abrupt changes of temperature that are active around. Their properties are such that they become the poorest exponents of those changes. Linen and cotton, on the other hand, as good conductors of heat, are susceptible to modifications of temperature. They render the body injuriously *au courant* with the condition of the surrounding atmosphere, and would encourage it to take part in all the changes of temperature to which that atmosphere is susceptible. These, then, are among the reasons why it is recommended that at all times woollen materials should be worn next to the skin, and from these facts it will be understood why woollen underclothing is advised for those who visit the Arctic regions, while it forms the best material for under-dress for such as are exposed to the heat of the tropics.

The body itself, moreover, is liable to certain modifications of temperature, which, although slight in degree, may yet be injurious in character, if abruptly brought about. I allude especially to the cooling of the body that is effected by the evaporation of moisture from its surface. Under certain circumstances this cooling may be excessive and abrupt, and as a result may arise disorders associated with catching cold. This matter is somewhat more concerned with bodily exercise than with external temperature, and its relations to the question of underclothing may now be noted. Let us suppose that two individuals undertake on a day in summer a similar exercise, the one being clad in woollen materials, the other in linen or cotton. If they are occupied in the open blaze of the sun, they will at the commencement experience about the same sensation of heat, provided that their garments are of the same colour ; for it

has been shown that colour rather than texture modifies the effects of direct solar rays. Shortly after commencing exertion, the man wearing wool next to his skin will feel warmer than the man wearing linen. The reason is this. Exercise increases the circulation of blood in the skin, and induces thereby a sensation of increased heat in the part. The woollen fabric by its rough surface would tend perhaps to irritate the skin, and by the friction induced by movement would probably still further encourage the circulation. There would be a trifling rise of temperature on the surface, and the skin would endeavour to cool itself by a copious perspiration. Now, the wool as a bad conductor would but tardily conduct away this new increment of heat, while at the same time its structure would cause evaporation of the sweat to be delayed and slow. The individual, therefore, would not at once experience the cooling effects of natural evaporation. In the case of the man wearing linen, he would feel less warm than his fellow, because the heat of the body would be rapidly conducted away, and the evaporation from the surface would be free, because the linen fabric would soon become wet, and by adhering to the body would still further favour the evaporating process. In process of time, however, the evaporation in the case of the individual clad in wool would be better established, the sensation of heat would be less marked, and the one man would feel as warm, or as cool as the other.

Now, suppose that they both suddenly cease from their exertions, and rest surrounded by the same conditions. In the individual wearing linen next the skin the evaporating process will—for reasons already given—be vigorous, and its cooling effects coming with the cessation of exercise will be somewhat sudden. A great deal of heat will be rapidly removed from the body, and the condition necessary for catching cold will be established. In the case of the man clad in woollen materials, the evaporation will proceed

leisurely ; the properties of the wool with regard to heat would tend to prevent a sudden loss of animal warmth, and the body would cool slowly. It is needless, therefore, to point out that woollen underclothing has overwhelming advantages, and that wool is, of all materials, the best suited for the varying circumstances of human life. One might conclude, therefore, by saying that underclothing should be of wool, and that that material should be worn next the skin, while under no ordinary circumstances should linen be worn next the skin. It is, perhaps, needless to add that the thickness and density of the fabric worn must be influenced by the climate and season of the year.

#### OBJECTIONS TO WOOLLEN UNDERCLOTHING.

The chief objections urged against woollen fabrics as materials for under garments are, I believe, the following : 1. They are heavy. 2. They often irritate the skin. 3. They are less cleanly than linen.

1. With regard to the first objection, it may at once be stated that for an equal weight, wool is the warmest material available for dress. A woollen shirt will be infinitely warmer than a linen shirt having the same weight. This may be allowed for winter attire, while it is urged that by wearing woollen fabrics in summer unnecessary weight is carried. But then it must be remembered that in the summer woollen materials of quite unnecessary thickness are often worn, and thus possibly a bias against such garments has arisen. As a matter of fact, the body can be properly clad with less amount of weight by wool than by any other material, and those who complain of the weight of woollen garments in summer have not yet found out a material thin enough or light enough for its purpose. The

matter will again be alluded to when speaking of woollen gauze underclothing.

2. It is perfectly true that woollen or flannel materials do often irritate the skin, and that that irritation is, in some cases, such as to interfere with their being worn. These irritating properties depend upon the roughness or coarseness of the material, and are directly due to innumerable minute filaments that project from the surface. The therapeutic value of flannel depends to no small extent upon its power of stimulating the skin. It is this power that makes it popular with the old, and with those whose circulation is sluggish. Amongst the poor, a common remedy for rheumatic and other pains consists in the application of a piece of new flannel to the part; the feeble efficacy of this treatment depends, I imagine, to some extent, upon the irritating effect of fresh flannel upon the skin. It is, indeed, in such cases a "counter-irritant." A French writer has ascribed a multitude of evils to the wearing of flannel next the skin. He gives cases of neuralgia and of various skin irritations that he maintains were caused by wearing flannel, and details an instance of sleeplessness that was ascribed—apparently with some truth—to the wearing of a flannel night-dress. In the great majority of cases the skin becomes accustomed to the irritation caused by woollen garments, and the stimulation of the skin that such garments promote adds then merely to the sense of comfort. For the old, the delicate, the scrofulous, and the rheumatic, flannel under-garments are especially desirable, and in such individuals complaint is seldom made of undue cutaneous irritation. But wool is worked up into other fabrics than flannel, and those who find this stuff uncomfortable should wear "merino" garments, or adopt the finer kinds of wool. Wool can, indeed, be woven in such a manner as to have a surface almost as soft and non-irritating as the surface of silk. In



hot weather particularly, rough woollen garments are apt to be uncomfortable, and should be replaced by those finer and thinner materials that are alone suitable for use in summer. Silk has properties as a dress material that are but little inferior to those possessed by wool, and in instances where wool does cause much irritation silk may well be worn next to the skin. Within the last few years crape has been introduced as a material for underclothing. It forms an admirable substance to be worn in contact with the skin. It is soft, pliable, light, and porous, and when made wholly or in large part of raw silk, possesses the more conspicuous advantages of wool. By those who cannot well adopt these alternatives, a "lattice-work," or gauze under-garment may be worn; and this, although made of cotton, does not have the injurious effect of a cotton garment, as it actually covers but a fractional part of the surface. Over such a garment woollen materials may be worn without discomfort.

3. Woollen materials absorb moisture freely, and when that moisture takes the form of perspiration from the body, its retention in the garment is not desirable for long. Unfortunately, woollen fabrics soil less readily than do linen structures, or rather, show less quickly the outward and visible signs of dirt. It thus happens that amongst the poor woollen underclothing is often worn without change for alarming periods of time. It is needless to say that this gross practice of uncleanness is injurious, and doubly so because woollen fabrics are particularly adapted for the accumulation and nourishment of those animal parasites that follow in the wake of filth. A woollen garment worn next to the skin should be changed as often, or nearly as often, as a like garment made of linen; and as the labouring classes are not likely to adopt this advice, it must be owned that on the score of cleanliness wool has decided disadvantages. With the well-to-do this objection does not,

or should not, hold, although it must be confessed that even educated people have often very crude notions as to what constitutes personal cleanliness.

#### GENERAL FACTS IN CONNECTION WITH UNDER-CLOTHING.

1. *Loose-fitting clothing is—other things being equal—warmer than tight-fitting.*—A woollen shirt, or under-vest, made quite loose will be much warmer than a like garment made of the same material, and of precisely the same thickness and texture, but so constructed as to fit the body quite tightly. In the case of the close-fitting garment, the material is kept in direct contact with the skin, and is therefore able the more readily to conduct away the heat of the body. In the case of the loose-fitting garment, there is a more or less constant stratum of air between the integument and the article of dress, and this stratum of warm air has an important influence on the bodily heat. Air, it must be remembered, is a very bad conductor of heat, and this stratum of air next to the skin acts almost in the same way as an additional garment. It is interposed as a non-conducting medium between the surface of the body and the external atmosphere.

2. *A material loosely woven is warmer than the same material closely woven.*—Thus wool or cotton, when carded and spread out as wadding, is warmer than would be the same quantity of material when spun into cloth. This depends upon the fact, already stated, that air is a bad conductor of heat, and the loose material, by confining air within its meshes, adds materially to its warming properties. At the same time, it must be remembered that a very dense fabric—such, for example, as fine and closely-woven flannel

—is peculiarly warm as an article for clothing, because its density interferes with the evaporation from the skin on the one hand, and prevents the penetration of cold winds on the other. Recently a material has been introduced for underclothing that consists of wool, cotton, or silk, made up into a kind of netting or lattice-work. It may be difficult at first to understand how a fabric so scanty that it has little more material in it than a fisherman's net could afford warmth to the body. But this substance allows a large stratum of warm air to be kept in contact with the body, and to this stratum its main value as a garment is owing. The fabric also allows of a free and normal action of the skin, and favours the maintenance of an equable temperature about the parts that it covers.

3. *Clothing worn in successive layers is warmer than the same amount of material in a single layer.*—That is to say, two shirts, or other garments, worn the one over the other, will afford more warmth to the body than would a single shirt containing the same amount of material as is required for the two garments. The truth of this statement can be appreciated by noting what has been already said respecting the non-conducting properties of air. Moreover, garments in layers would offer more resistance to the penetration of cold winds and less support to the process of evaporation than would a single garment containing an equal amount of material.

4. *Underclothing should be light and porous*, and free from any ornamentation that would add very materially to its weight. It should be permeable to air, for the reasons that have already been fully detailed. Thus it will be seen that very fine materials, such as very densely woven flannel, are often open to objection.

## NIGHT ATTIRE.

The above remarks apply to clothing worn during the active part of the twenty-four hours. A night-dress should be of linen or cotton. Such a material is advisable, inasmuch as it gives rest to a skin that may have been unduly stimulated by woollen under-garments during the day. It is, moreover, worn under conditions that favour inactivity of the functions of the skin, and is therefore little concerned in the process of evaporation. While in bed, the body depends for its warmth upon the bed-clothes, that, as a rule, are represented by a considerable amount of woollen material or down. The night-dress, therefore, fulfils the requirements of cleanliness and personal comfort rather than the primary needs of dress. While in bed, moreover, the body is surrounded by a considerable amount of warm air. Under ordinary circumstances, in this climate at least, the use of woollen fabrics for night clothing is to be condemned. Such garments may not afford to the skin a needed rest. They may promote perspiration under circumstances when it is neither desirable nor controlled by ready evaporation. They may maintain the body at an unnecessarily high temperature, and they may tend to the neglect of proper cleanliness. By quite young children, and by the old, where the animal heat is but feebly maintained, such garments may be worn in addition to the linen dress. They may also be advisable for the rheumatic, and in certain forms of delicate health and of disease; and they may be absolutely necessary in very cold climates.

## MALE DRESS.

*The Head.*—The natural coverings of the head, and the peculiarities of the structures within the skull, are such that the matter of dress as applied to this part requires to be discussed upon peculiar grounds. In the first place, the scalp is dense and thick, and is more freely supplied with blood than is any other part of the skin of like extent. The liberal circulation of warm blood through the scalp enables its temperature to be well maintained, and renders it to some extent independent of those fluctuations of temperature that exist without. The hair, moreover, forms a natural covering or dress for the head, and being a bad conductor of heat, it possesses, when tolerably thick, many of the valuable attributes of a woollen garment. Within the skull is the brain. Owing to the density of the scalp, the thickness of the skull bones, and the many layers of different tissue that intervene between the outer world and the brain, this organ is not readily affected by external modifications of temperature. If the head is exposed to chilling influences, the individual may catch a cold, but he is not likely to develop a headache. The ill effects of the chill, it would appear, do not penetrate to the brain, although cases are noted where inflammation of the brain or its membranes has followed, or been supposed to follow, upon exposure to cold. Such cases, however, must be quite infrequent. Heat has a somewhat less superficial effect, and an exposure of the imperfectly covered head to intense solar heat may lead to the brain disorder known as sun-stroke.

The head, moreover, seems peculiarly susceptible to even slight degrees of heat. If the head be rendered unduly warm by a thick or heavy hat, a sense of discomfort is soon experienced, which is perhaps more marked than are like

sensations in other parts. There would appear to be a generally expressed desire that the head should be kept cool, and in warm or moderately warm weather there are few things more refreshing than a temporary artificial cooling of the scalp. The brain, like the outer covering of the skull, is very liberally supplied with blood, and its circulation is readily influenced by an exercise of the function of the organ. During mental exertion or mental excitement, an unusual quantity of blood is brought to the brain by its blood-vessels. A sense of heat and fulness in the head, with possibly headache, may follow. Now, there are communications between the blood-vessels within and those without the skull, and by diminishing the circulation in the latter, relief is given, to some extent, to an engorged condition of the former. Thus, cold to the scalp may relieve the discomfort felt during or after severe brain work, while, on the other hand, additional warmth to the scalp would certainly add to that discomfort. We hear of students adopting the somewhat questionable practice of reading with a wet handkerchief round their heads, and there is no doubt that this practice would more readily modify any discomfort that may attend prolonged brain work, than would the practice of studying in a heavy black hat. It must be remembered that the skull is unyielding, and that an addition of material to the parts within the skull would soon be felt, even if that addition is merely represented by a little extra blood. These and other facts may serve to explain the *rationale* of the popular advice to keep the head cool.

In studying the history of the development of dress, it would appear that the hat was somewhat late in appearing upon the scene, and that the head was among the last parts of the body to be covered. There are millions of individuals at this present time in the world who from birth to death wear no covering for the head. It may

indeed, with some reservation, be said that, of all parts of the body, the head is the part least needing to be covered. It has, in truth, a good natural covering of its own. This covering, although it meets with all the requirements of simple savage life, does not fulfil all the needs and the artificial conditions that arise out of a civilised existence. Thus, hats become a necessity. The dense "wool" on the negro's head forms an admirable covering. It is light; it is a bad conductor of heat; its arrangement is such that its interstices are occupied with air; it affords, for a while at least, a protection against rain, and, even when quite wet, is able to completely annul the possible ill effects of much moisture in contact with the skin; it is not quite innocent of grease, and the admixture of oily matter adds to its property as a feeble conductor of heat; it defies the sun, and by its denseness and elasticity affords no mean protection from external violence. As far as the needs of health are concerned, the wearing of a hat by an individual with so good a head covering as the negro possesses is a pure work of supererogation.

On the other hand, the thinner the layer of hair the greater is the need of some artificial covering for the head, and for a bald man such a protection becomes an absolute necessity. It would appear that as civilisation advances the hair becomes somewhat scantier and less robust. I imagine that, in the matter of hair, the heads of the people of this country at the present day would not compare well with the heads of the ancient Britons, of whose dense and matted locks history gives some account. I think especially that the prevalence of early baldness may not unreasonably be ascribed to certain conditions incident to civilisation.

Before coming to the subject of hats, one word may be said as to the practice of saturating the hair with oil or grease. This dirty and offensive habit—which is probably

less common than it was—is the relic of the savage taste for soaking the hair with fatty matter. It is, I believe, in Abyssinia that certain natives delight to obtain a mass of grease, which they place on the head under the cover of a leaf. As the fat melts, it soaks well the hair, and then runs down over the neck, shoulders, and trunk. The pleasure derived from this pursuit may depend upon the glistening effect produced by oiled surfaces, but I imagine that it is mainly due to the additional comfort that the layer of so bad a heat conductor as oil gives to the body. This latter property of oil may serve to explain its original use when applied to the hair. There is normally supplied by the scalp a quantity of oily matter sufficient to maintain the hair in good condition, and there appears to be no excuse for the custom of soaking the hair with a material that decomposes and becomes rancid, and favours the accumulation of dirt and the fostering of parasites.

*Hats.*—The object of a hat is to protect the head from undue cold in the winter and from undue heat in the summer, to protect it from rain, to offer some shield to external violence, and some opportunities possibly for adornment.

It is doubtful if any one kind of hat would meet perfectly and equally all these requirements at once. It is particularly necessary that any hat worn should be *light* and *well ventilated*. A heavy hat presses with undue weight upon the scalp. It produces by that weight a sense of oppression and constriction. It may somewhat diminish the blood supply of the scalp by pressing upon the vessels that nourish it. Lastly, it is apt to injuriously press upon the nerves of the part, and so produce headache and neuralgia. It is asserted, moreover, on what I think are probable grounds, that the long-continued wearing of heavy hats tends to produce baldness. With regard to the actual weight of certain hats, it may be interesting to note that the ordinary



tall black hat weighs from 5 to 7 oz., the infantry shako, according to Parkes, weighs  $9\frac{3}{4}$  oz., the engineer's busby,  $13\frac{1}{2}$  oz., the lancer's cap,  $24\frac{1}{2}$  oz., and the "bearskin," 37 oz. The last item is significant, if it be borne in mind that a proper covering for the head can be obtained from material weighing, let us say, 3 oz., so that in the "bearskin," ornament and perhaps protection from violence are represented by no less than 34 oz. In designing the "bearskin," health must have been represented by the figure 1, adornment by the figure 10.

In the next place, a hat, whether light or heavy, must be well ventilated. The scalp perspires as does the rest of the skin. In a badly ventilated hat, the air within the hat and in contact with the head soon becomes fully charged with moisture, evaporation is in abeyance, the perspiration collects in visible amount, and the natural means for cooling the surface of the part are destroyed. Thus a badly ventilated hat soon produces a sense of heat and oppression. The wearer feels constrained to lift it from his head whenever he can, and if only for a moment. By such means alone can he bring a drier air in contact with the scalp, and so re-establish the normal process of evaporation. Thus it happens that a non-ventilated hat is very apt to produce a cold, owing to the sudden fluctuations of temperature to which the head may be exposed. For when the hat is on, the part will be unduly warm; when suddenly taken off, its temperature will tend to fall abruptly, owing to the removal of heat by evaporation.

It is absurd to suppose that a hat can be ventilated by a few holes being punched here and there. The partly occluded aperture in the crown of most tall hats is a singular burlesque on the needs of ventilation, and is, of course, perfectly useless. A hat that aims to be properly ventilated should permit of a current of air through its interior when it is fixed upon the head. There should be an

aperture in the crown through which the air heated by contact with the scalp could escape, and apertures about the brim of the hat by which fresh air could enter. Several hats fulfil these conditions by means more or less ingenious, although it would appear difficult to fully attain these ends without visibly increasing the dimensions of the head covering.

To protect the head against *cold*, the covering should be made of some feeble heat-conducting material—should be light, well ventilated, and of dark colour. Thus, I think that the best hat for the winter in this country is one made of felt or dense woollen cloth dyed black, free from rigidity, and properly ventilated. To meet extreme cold, the fur cap worn by Arctic travellers fulfils its purpose well. The fur is a poor heat conductor, while the skin to which it is attached serves as a good protection against penetrating winds. Owing to the inactivity of the skin in an atmosphere of extreme cold, the ventilation of such a cap is practically, a matter of no importance.

As a protection against solar *heat*, the head-dress should be light in colour, or, if possible, quite white. It should be perfectly ventilated, and free from even a fraction of unnecessary weight. It should possess either a broad brim or be of helmet shape, so that it may afford some protection to the face and back of the neck. For the summer in this country no head-covering could be better than a common white straw hat, provided that its texture be loose enough and coarse enough to allow of a free passage of air through all its parts.

For hotter climates—as, for example, India—a somewhat more elaborate head-covering is required. “The head-dress, to be effective,” says one writer, “should possess such resisting powers as to ward off entirely the whole rays of the sun throughout an exposure to its action of any duration, and not only from the skull, but also from the sides of the

head, face, and neck. It ought also to transmit so copious a ventilation over the head as to encourage the perspiration to evaporate freely from it. At the same time, such a head-dress should be no more cumbrous than is necessary to fulfil all these conditions completely.\* The head-dresses most strongly advised for wear in India are made of pith or bamboo wicker-work, and are covered with white cotton (Parkes). Especial arrangements are made for the perfect ventilation of the interior, and the whole structure is extremely light. For many reasons, the helmet shape is the best that can be adopted, and its outline is peculiarly favourable to proper arrangements for ventilation. It may be well to note that "sun-stroke," or "heat-stroke," does not of necessity depend upon the direct action of solar rays. Sun-stroke may, indeed, occur when the sun is not shining; and at least one writer upon the subject has asserted that "the direct influence of the sun has nothing whatever to do with its production."† The symptoms of sun-stroke would appear to be due to many causes, all of which are dependent upon an abnormal increase in the temperature of the body. It is well known how the occurrence of the malady is favoured by violent exercise during periods of extreme heat, and much stress has been laid upon a diminished activity of the heart's action as an essential feature in this disease. It is, however, very certain that the liability to sun-stroke is greatly diminished by a proper head-covering, although it must not be concluded that sun-stroke cannot occur when such a head-dress is worn.

In the matter of particular head-coverings, the ordinary tall black hat possesses perhaps the greatest number of bad points and disadvantages.

It is heavier than a hat need be, it is rigid, it is

\* "The British Army in India." By J. Jeffreys. London, 1858.

† Nothnagel. Ziemssen's "Cyclopædia of Medicine," vol. xii., page 43. London, 1877.

impervious to moisture, it compresses the scalp in an unyielding line, and usually presents no opportunities of ventilation. To these disadvantages it adds the feature of being peculiarly ugly. This hat, moreover, is worn both in cold weather and in hot, and is particularly affected by those who may reasonably be supposed to be desirous of "keeping their heads cool." This eccentricity in modern dress is bad enough when worn in winter; but as a covering for the head during the height of summer it could hardly be more unsuitable.

The soft black felt hats worn by certain clergymen and others are good head-coverings for the winter, but in the hot seasons of the year they are objectionable by reason of their colour and their density of structure. The skull-cap and the fez have drawbacks in that they closely embrace the head, and are usually of so close a texture as to prevent the escape of the moisture from the skin. The straw hat favoured by the boating-world, and by those "who go down to the sea in ships," as well as the light white cap of the cricketer, are sensible and suitable for reasons already given. The black and heavy helmets of the police force must be mild means of torture during the dog days and in the "baking streets." The head gear of the army is open to many objections on the ground of health, although at the present time its evils are lessened by the modifications it undergoes when the wearer is subjected to extremes of climate. Lastly, the college cap, or "mortar-board," while tolerated out of respect to ancient custom, is an offence against the laws of health by its weight, its uniform black hue, and its scanty provisions for ventilation.

To what extent the robust, and especially those who are both robust and young, can dispense with head-coverings altogether is illustrated by the pupils of Christ's Hospital. They appear to suffer no inconvenience from their peculiar

attire, although some protection for the head is considered necessary when they are exposed to the heat of the sun in summer. Some thousands of street Arabs in the Great City thrive—so far as such mortals can thrive—with no covering for the head but a mat of dirty hair; and it is not uncommon in the country to see men and women labouring in the fields with no head-dress other than that provided by nature.

And now as to the covering of the head at night: a man might as well sleep in his boots as seek repose in a night-cap. With but very few exceptions, this article of dress is entirely superfluous, even when not injurious. During the night the scalp has an opportunity of recovering itself from any evils that continued hat-wearing may have brought about, and that opportunity should be seized. In the time of wigs, a night-cap was not only excusable, but even essential, to prevent too sudden a change of temperature, incident upon the removal of a heavy mass of false hair. For certain delicate individuals at the present day such a head-covering may be necessary. It may be of benefit also to the old, to the rheumatic, and certainly to the bald. But for the majority of individuals the night-cap is no more an essential to health than it is a contribution to personal beauty.

*The Neck.* — The neck contains many structures of importance. In it run the great blood-vessels (the carotids) that supply the face, head, and brain, and the great veins (the jugulars) that return the blood from those parts. In the middle line is situated the larynx, or organ of voice, and also the trachea, or wind-pipe. Behind these structures is placed the gullet. At the sides of the pharynx, or upper part of the gullet, the tonsils are located, and beneath the skin of the neck are clustered a number of lymphatic glands that are apt to become enlarged and inflamed under certain circumstances.

In discussing the question of dress as applied to this part of the body, it is necessary to consider : 1, the advisability of constricting the neck on the one hand, or of allowing it free movement on the other ; and, 2, the importance of entirely covering up the part, or of leaving it unprotected by clothing.

1. The neck is susceptible to many and frequent movements. Its proportions are altered in nearly every motion of the head. During the acts of deglutition and vocalisation its outline undergoes a visible modification. It is indeed a part seldom left at rest. Any constriction would seriously hamper these movements, and tend to interfere with the functions to which they administer. Constriction, moreover, has some effect upon the blood-vessels of the part. It may lead to more or less compression of the veins that are bringing the blood from the brain and head, and thus induce some congestion of the parts whence these vessels have issued. The neck, therefore, should be so clothed that all its movements and the changes in its proportions remain unhampered. Stiff stocks and high collars, that reduce the neck of man to the condition of the neck of a plaster figure, are in many ways obnoxious. Equally objectionable are tight scarves, neckcloths, or collars. They interfere with more than one important function, and are apt to hamper the blood circulation. For this latter reason, any constriction of the neck by an article of dress is peculiarly objectionable in the plethoric and in those whom the laity denominate "apoplectic." Perhaps the evils inflicted by tight scarves, &c., upon these individuals have been exaggerated, but their possibility can certainly not be ignored.

2. The question as to whether the neck should be entirely covered up or left more or less unprotected, must be settled rather by an appeal to individual cases than to general principles. As a rule, it should be but slightly and

partially covered. Indeed, during warm weather and when in the house, the less the neck is protected by clothing the better. A scanty amount of clothing about the neck allows of an opportunity for ventilating the surface of the trunk (if such an expression may be used) and allows all movements to be unimpeded. In very cold weather, and in delicate individuals, it is needful, of course, that this part of the body should be well and warmly clad. Custom has great influence upon this matter. The sailor, whose neck is somewhat obtrusively bare, is no more liable to affections of the part than is the soldier, in whom the neck is, perhaps, too entirely protected by clothing. I can imagine that if the sailor were suddenly to adopt the neck costume of the soldier, or the soldier that of the sailor, some inconveniences might arise. These evils would serve to illustrate the fact that the body resents abrupt changes, while it tolerates those that are of slow development.

On the whole, and so far as the climate of this country is concerned, the manner in which the neck is clad at the present day would appear to be well in accord with the dictates of health. It avoids the extremes of the Byronic attire on the one hand, and the extensive neck-dress worn about the time of the French Revolution on the other.

*The Trunk and Extremities.*—In the matter of male attire as applied to the trunk and extremities little need be added to what has already been stated in dealing with the comparative value of certain dress materials and the subject of underclothing. The outer garment should conform to those rules that are dictated by a consideration of the primary purposes of clothing, and should aim at properly protecting the body, and at maintaining it everywhere at an equable temperature. These garments should be so constructed as to avoid compression of any part, and should be free from superfluous weight.

With regard to this latter point, it is difficult to give sound data without at the same time entering into many and needlessly minute details. It is possible, however, to appreciate the weight of clothing worn by those whose costumes are uniform and liable to but slight modification from time to time. As examples of such, we may take the dress of soldiers and sailors.

According to Dr. Parkes, the weight of clothing worn on the person of an infantry soldier amounts to about 10 lb., this estimate including the shako, winter trousers, and leggings. The infantry great coat weighs on an average from 5 lb. to 6 lb. Dr. Buck gives 9 lb. as the average weight of the clothing usually worn by sailors, and 13 lb. 8 oz. as the weight of the entire suit, including the overcoat, cap, and shoes.

Recapitulating what has been already stated, it may be said that woollen outer garments should be worn in cold weather; while in summer the material is—other things being equal—of less importance than colour, and in hot weather the best outer garment is one made of cotton or of like substance, either white or of light colour. Garments worn in successive layers are warmer than a single garment containing the material of many. The dress fabric should be porous within reasonable limits, and should not be worn too tightly applied to the body. It must not be supposed—as some would appear to believe—that one single garment is equally well adapted for both hot weather and for cold.

In this country, among a certain class of men, one uniform black coat is worn throughout the year, quite irrespective of changes of temperature and climate. The laws of society are opposed to the indiscriminate use of healthy dress; and in selecting attire there are many who must conform to social dictates before they can attend to the demands of health. To a professional man a black frock coat may be a suitable



enough garment for an English winter, but the usages of society would not tolerate the spectacle of a physician visiting his patients in the summer clad in white cotton trousers and a cotton blouse, with a white straw hat, and a neck innocent of collar or scarf.

Trousers should be suspended from the shoulders by means of braces. Belts and waistbands of all kinds are objectionable. They involve more or less constriction of a part that is often seriously affected by constriction, and that especially requires freedom of movement. In men the outline of the body is such that there is but an insignificant amount of waist, and the hips when compared with those of women are not prominent. The practice of bracing a belt tightly round the waist when about to commence vigorous exercise is particularly objectionable, and may lead—as one writer has pointed out—to the development of rupture.

Braces should be of elastic rather than of non-elastic material, in order that they may conform more readily to changes in the posture of the body. The braces commonly used to suspend the nether garments are objectionable in that they involve, in to and fro movements of the body, a considerable amount of friction, and some slight amount of strain upon the shoulders. This objection would be met by a brace so constructed that the part crossing the shoulders would remain unmoved during changes in the posture of the body, while the necessary movement was thrown upon that part of the brace that is attached to the trousers.

Tight leathern breeches are injurious in that they interfere with muscular movement, and hamper the proper exercise of the muscles, while at the same time they harass the surface circulation of the limb, and are apt to make the thigh cold and often numb. These evils are intensified when the garment is not only too closely applied to the

extremities, but serves to constrict also the region of the groin.

Dress as applied to the *Hands* and *Feet* will be discussed in dealing with the subject of women's dress.

### FEMALE DRESS.

*The Head and Neck.*—The general circumstances that influence the proper clothing of the head and neck have been already considered. It remains to take note of some few points that are especial to women in connection with these regions. If the male head actually requires but little covering, the female head is certainly in need of still less. In the first place, women are provided with a more dense and abundant covering of hair than men can boast of, and it is possible for that hair to be so arranged about the head as to discharge nearly all the functions of a perfect hat. There is, or was, for example, a fashion of “doing” the hair that consisted in forming it into several plaits, that were then lightly coiled round the head so as to evenly cover it over the greater part of its extent. By this means the head was provided with a natural cap, made of a material that of all others would appear to be the most suitable as a covering for it, that was light, easily penetrated by air, pervious to moisture, and not readily influenced by change of temperature. In ancient Greece the hair appears to have been so worn as to render the head, under ordinary circumstances, independent of artificial protection. This was effected by keeping it moderately short, and by massing it more or less evenly over the head. The hair was thus kept loose, and the scalp free from unnecessary compression. As one other example, may be noted the fashion of wearing the hair short, and of splitting it up into a thousand small curls that evenly

covered the head with a light but efficient covering. In such a method the scalp is protected by means that find their most complete fulfilment in the woolly head of the negro.

In the next place, women are much less exposed to the vagaries of climate than are men. They are not (or should not be) exposed to a scorching sun for many hours while engaged in some laborious work, nor, under ordinary circumstances, are they required to battle with wind and rain; their life is such that it is spent rather under shelter than in the open, and even their outdoor amusements do not usually call for much intimate acquaintance with the "elements."

Lastly, the parasol must be regarded as a kind of hat. I would not for a moment advocate the use of this *impedimentum*. But its adoption is very general, and it may fairly be considered as affording a covering for the head. The thickness of the hair and the excellent blood supply of the scalp afford substantial protection against cold, but against solar heat the civilised female requires artificial aid. The parasol is certainly not the best means of affording that assistance. It has to be supported over the head, and is one of the many little obstacles in the way of an easy and graceful carriage. That women can without detriment go with the head practically bare—if we exempt the umbrella and sunshade as head-gear—was, I imagine, practically demonstrated some years ago, when the bonnet was reduced to such microscopic dimensions, that by no stretch of language could it be said to have covered the head.

Whatever artificial covering is adopted for the female head, it should at least have these qualifications: It should be light, and pervious to air and moisture. It should maintain the head at all parts at an equable temperature. It should not constrict the scalp, and it should be

competent to protect the eyes from the glare of the sun. There is a tendency, perhaps, in women to carry too much rather than too little upon the head. Considering the hair as a head covering, it is often most indiscreetly used. It is allowed to grow too long, and to oppress the head by its needless weight ; or it is massed into knobs and protuberances, that leave one part of the scalp almost bare and another part unduly covered up ; or the abomination of false hair is indulged in, and collections of this material are located upon the scalp in spots indicated by fashion, with the result that undue pressure is brought to bear upon the skin, and the temperature of the head is disturbed, and rendered unequal. Apart from this, there are details associated with false hair which are not at all pleasant to contemplate.

With reference to *bonnets*, they are often rendered unduly heavy by superfluous ornament, even if not of much weight in themselves. Bonnets and hats, moreover, are frequently poised on one segment of the head only. They have been worn located at the back of the head, so as to leave a considerable portion of the vault quite bare ; and have, on the other hand, been worn so far forward as to approach the eyebrows. Bonnets should, if possible, protect the eyes from the glare of the sun. At present this protection is afforded by the parasol, which is tolerated because just now it is unfashionable to exhibit upon the cheeks the signs of health. The edicts of fashion assert that the complexion must be "preserved ;" a sickly pallor is more to be desired than a ruddy skin, and there is some vulgarity surrounding the "nut-brown maid." So long, therefore, as the natural effects of sunlight and a freshening breeze upon the healthy cheek are vulgar, so long will parasols be a necessity. When, however, the popular taste will allow that there are beauties in health as well as in disease, the sunshade may be cast aside, the face may be freshened by sun and wind,

and a bonnet may be worn so constructed as to shade the eyes from glare.

One word with regard to *veils*. They are worn, I am told, for many reasons. They keep the hair from being blown about ; they help to maintain a bonnet in its place ; and they serve to hide a coarse skin, and to modify the effect of a spotty complexion. It is for others to judge whether these objects are sufficiently weighty to countenance an article of dress that must under any circumstances be uncomfortable. I do not for one moment believe the statements that have been advanced to the effect that veils cause short-sightedness, squinting, and blindness,\* although they must interfere a little with vision when worn.

When carried over the mouth they soon become saturated with moisture, and thereby cause all the air that is inhaled to be unduly charged with dampness. This can scarcely be other than a disadvantage. The veils thus moistened, moreover, may in cold weather lead to chapping of the skin and to cracked lips, and, owing to the poisonous dyes that the veils sometimes contain, may induce certain conspicuous eruptions of the face.

*The Neck*.—The observations that have been already made upon the clothing of the neck in males apply equally to the opposite sex. But a few especial points have to be noticed. Perhaps the most common fault observed in the neck clothing of women consists in the frequent changes that are effected in the amount of material worn round the part at various times. At one period of the day the neck may be well covered up to the chin, while at another period (as, for example, when an evening dress is donned) it may be suddenly left absolutely bare. To keep the neck *constantly* well protected by clothing may not be an evil, nor may it be injurious to leave it *constantly* entirely bare, but it

\* "Dress and Health," p. 75. Montreal, 1880.

certainly is an evil at one time to protect the part elaborately, and at another to leave it free from all covering. Sudden fluctuations in the circulation and temperature of the skin are not well borne in any part of the body, and the neck forms no exception to the rule. As to what may be the actual manifestations of this unwise practice it is perhaps difficult to speak with precision. I think it will, however, be allowed that women are more prone than men to sore throats, to colds, to mild attacks of laryngitis, associated with some loss of voice, and to swellings of the lymphatic glands in the neck. It may not be incorrect to assume that these evils are often to be traced to the uncertain covering of the female neck, and to the abrupt fluctuations of temperature to which that part is sometimes exposed. Women, perhaps, indulge more frequently than men in the practice of wearing tight collars and bands around the neck. This practice appears to be less common since the admiration for a "swan-like neck" has waned, and since it has been demonstrated that such a neck is generally the outcome of an undesirable degree of emaciation.

Dr. Vaughan, in his remarkable essay on dress, observes that "three times in his life he has seen them (collars) so tight as to break while the ladies who wore them were dancing."\* These accidents are certainly less common at the present day, but at the same time it is desirable to remember that any constriction of the neck, however slight, cannot be other than injurious.

*The Trunk and Extremities.*—Under this heading, which practically involves the consideration of the whole attire of women, a great deal has to be said. It must be confessed that the dress of women at the present day is in many points extremely bad, that it is as a whole unreasonable, and in many details purposeless, and that it tends to be

\* "An Essay, Philosophical and Medical, concerning Modern Clothing," p. 54. London, 1792.

injurious to health, and to interfere with the proper functions and development of the body. Much—possibly too much—has been said of late upon the evils, both real and imaginary, of the female attire of the present day, and vigorous reforms have been instituted for its improvement. These attempts at a dress reformation have been—like other reforms—often violent and premature. They have been ushered in with exaggerated statements as to the evils of modern dress on the one hand, and the benefit of some “hygienic costume” on the other, and not a little has been done to delay the progress of a sound reform by the extreme action of the apostles of change. It is necessary, therefore, in dealing with this matter, to proceed with caution, and upon the lines only of simple fact, avoiding extremes, and especially the hysterical utterances of the alarmist, while taking into consideration also existing tastes and what may be fairly considered as existing interests.

I propose first to point out the defects and evils in the female attire of the present day, and then to indicate the manner in which those evils may be remedied, and the lines upon which a healthier form of dress may be constructed.

*Underclothing.*—Before attempting any criticism upon this matter, it is well to bear in mind the requirements of healthy dress. They are, the perfect covering of the body, the maintenance in all parts of an equable temperature, the absence of superfluous material and needless weight, and the non-interference with any of the normal functions of the organism.

In the first place, the material worn next to the skin by the majority of women is either linen or cotton. The total unsuitability of such materials for underclothing has been already pointed out (pages 37 to 41). It is true that women are not commonly exposed to such extremes of temperature as

men often endure, but at the same time they are probably more susceptible to fluctuations of temperature, and more liable to suffer injury from such changes. It is very desirable, therefore, for reasons which have been already given, that woollen fabrics should replace those which are now so commonly, and certainly in some cases harmfully, worn next to the skin. In the summer, and by those persons whose skins are unduly irritable, a silken material or a gauze fabric may be worn in contact with the body, but there are no ordinary circumstances that render linen under-garments either desirable or likely to be free from injurious effects.

The ordinary linen or cotton garment that is almost universally worn over the trunk, is in many respects a ridiculous article of dress. It leaves the neck and upper half of the chest bare, and, being sleeveless, it affords no covering for the arms. It is, moreover, needlessly loose, and instead of fitting the body and clothing it evenly, it becomes thrown into folds about the waist, that add to its unequal properties as a maintainer of the warmth of the body. As an article of dress, therefore, it is very defective, and somewhat purposeless, involving also an expenditure of material out of proportion to its value as an element of healthy clothing.

Referring more generally to the unequal distribution of warmth that women's dress encourages, it must be noted that in the case of a female clad in the ordinary way, the character and arrangement of her garments are such that the body is found to be most unevenly covered, and that certain parts are kept unduly warm, while others are allowed to become unnecessarily cold. *A propos* of this matter, it is, perhaps, needless to refer to the *low-necked dress*. This costume has been so extensively and so systematically abused that further condemnation of it may be unnecessary. Certainly, few forms of attire could



exhibit more glaring errors, or be less consistent with the requirements of health.

To come, however, to every-day attire: the condition of a woman clad as the great majority of the sex are clad, is thus graphically described by an American lady\* who has written much on dress:—"The limbs have not half the amount of covering which is put upon the trunk of the body. Many garments have no sleeves, and what sleeves there are either come to an end a few inches below the shoulder, or they are loose and flowing at the wrists, so as to expose the arm as far as the elbow to the cold air. As to the legs, the clothing, which should increase in direct ratio to the distance from the body to the feet, diminishes in the same ratio. Thin drawers, thinner stockings, and wind-blown skirts which keep up constant currents of air, supply little warmth to the limbs beneath. The feet, half clad and pinched in tight boots, are chilled in consequence. The trunk of the body has as many varied zones of temperature as the planet it inhabits. Its frigid zone is above, on the shoulders and chest; for, although the dress body extends from the neck to the waist, most, if not all, of the garments worn beneath it are low-necked. The temperate zone lies between the shoulders and the belt, for that region receives the additional covering of under-vest, corset, and chemise. The torrid zone begins with the belt and bands, and extends to the limbs below, for all the upper garments are continued below the belt, and all the lower garments come up as far as the belt, so that the clothing over the whole hip region must be at least double what it is over any other section. But it is more than double; it is quadruple, for the tops of all these lower garments have a superfluous fulness of material which is brought into the binding by gathers or by plaits." Indeed, the ordinary female dress, although it may be good in quantity

\* Mrs. Woolson: "Dress and Health." Montreal, 1880.

and good in quality, is yet very prone to be bad by the manner in which the materials that compose it are distributed.

This unequal distribution of heat over the surface of the body is an offence against definite physiological laws, and cannot prove other than injurious. It may be that the injury inflicted is in many cases slight, but it is not on that account to be ignored. On the other hand, it must be asserted that under certain circumstances the ills that may arise from this faulty protection of the body may be very grave, and prove the source of special disease and "delicate health" to many women. The clustering of many garments about the waist is obnoxious in several ways. In the first place, the plan must cause some constriction of the waist and some pressure upon the abdomen; and, in the second place, it must maintain the part in an undesirable state of warmth when compared with the surface temperature of the rest of the body. A lady, writing upon this subject, asserts that it is possible for a woman clad in winter attire to have her waist encircled by *fourteen* layers of clothing material. This somewhat alarming announcement is explained by the statement that the garments attached about the waist are usually "attached to a double band" in each instance. Thus, the fourteen layers represent seven actual garments. The waist is the district between the lower ribs and the hip bones. It is a part readily constricted, and around it these nether garments are attached. There is no doubt that some portion of the weight of this clothing is borne by the hip bone direct, and is, therefore, comparatively harmless, especially in women with prominent hips. But a certain amount of support for the garments must be derived from direct pressure of the waist, and this must be still more conspicuous in the stout and in those who, like the young, have slight hips. This constriction cannot fail to be injurious. It interferes with the proper action of the

abdominal muscles and with the functions of those viscera that come within the line of pressure. It acts perhaps most injuriously upon the organs especial to women, and the change in the position of the womb that a tight band around the waist can produce has been demonstrated by a well-known writer on the diseases peculiar to the sex. I think that without doubt a number of these diseases, which are of alarming frequency and of no trivial character, may owe their origin to this heavy, ever-dragging coil around the waist, and in cases where some other cause can be ascribed to the malady, I imagine that this constant downward pressure and constricting force is an active agent in exaggerating the disease.

It must not be presumed that the pressure effects of many garments attached round the waist are obviated by wearing a corset beneath them. The pressure is merely modified and redistributed, while not one fraction of the weight is removed.

Then, again, this multitude of bands above and about the hips tends to keep the region unduly warm, and to lead to congestion of the pelvic viscera. These viscera, which include the organs especial to women, are from their position peculiarly liable to congestion; and it is not difficult to understand that many layers of warm clothing in the vicinity of these organs will increase that tendency.

While the hip region is somewhat too well provided with clothing, the lower extremities are imperfectly, and certainly injudiciously, covered. As an American physician oddly expresses it, "The legs, clad with one thickness of cotton, go paddling along under a balloon." This brings us to the consideration of the *petticoat* as an article of clothing, and especially as a covering for the lower limbs. This garment is, no doubt, of infinite value among primitive communities, where it forms the sole attire of the female

population, but it does not appear to be suited to modern needs, nor is it the most sensible or economical way of clothing the lower extremities. One would imagine from the attire of the ordinary woman that she was a one-legged animal. To vaguely surround two distinct limbs with one garment is certainly the least direct method of clothing them, and to superimpose a second garment over the first when increased warmth is needed is a proceeding as lacking in reason as it is prodigal in material. Petticoats, however well they may suit the decorative aspects of dress, are, as articles of clothing, bad in many ways. Their weight is considerable; they seriously impede movement; by hampering the action of the lower limbs they involve an unnecessary expenditure of muscular force, and if long enough to reach the ground they serve to accumulate dirt. These wretched garments limit immensely the outdoor amusements of women—they put a tax upon all forms of exercise that involve a use of the lower limbs. They are an actual drag upon the wearer, and form one of the main obstacles in the way of the proper physical development of women. It is of little use to attempt to advise a woman to take a ten miles' walk on a winter's morning, in the place of sitting at home over a fire, if that walk involves the dragging about of a great weight of clothes which by dangling about the legs adds to the burden to be borne. Surely, the most reasonable way of covering the lower extremities is by clothing each limb separately. Such a plan involves the need of only one garment (in addition to the outer dress or gown), no matter whether the weather be warm or cold, for when additional warmth is required it can be obtained by simply increasing the character or the thickness of the material used. If in winter women were to clothe their lower extremities separately with some suitable woollen fabric, they would be in no more need of petticoats than are men. Instead of the lower part of the body being hampered with a multitude of garments, there would be two

only—an outer dress and a proper under-dress for the extremities. If a petticoat be needed for decorative purposes it could be added, but only then as an element in the ornamental province of dress. Such a costume would, I presume, present the same external appearances as are shown by the ordinary dress of the time; and in practically abandoning petticoats and clothing the lower limbs in a sensible fashion, women would be introducing no very terrible innovation. I think, moreover, that this method of clothing the lower extremities would be somewhat more decent than is the petticoat arrangement, and would render the position of a woman on a windy day less embarrassing.

The evils that have just been alluded to are exaggerated by long skirts, by “tied-back dresses,” and by heavily ornamented gowns. Every additional ounce of weight in the garments that surround the limbs means so much additional muscular exertion, and the dress, elaborately decorated by much superfluous material, represents a terrible and superfluous amount of work for muscles that are perhaps already burdened enough.

*Tight Sleeves.*—The evils attendant upon the wearing of tight sleeves, although not considerable, are yet sufficiently pronounced to render such a form of clothing objectionable. Sleeves that tightly embrace the limbs interfere with the venous circulation of the part, and tend to make the fingers bluish and cold. In cases where the tightness extends well up into the arm-pit, some swelling of the hand and other inconveniences may follow. Pressure upon the nerves of the limb, which, for the most part, run at no great depth beneath the skin, may lead to neuralgic pains in the extremity, or more probably to some numbness of the fingers. Moreover, the tight sleeve interferes seriously with muscular action, and restricts the range of movement of the arm. It is impossible for a person to grasp so firmly with the arm

compressed by a sleeve as when the limb is free from constriction; and there is probably not a very great number of women who can *freely* make their hands touch over their heads. Dr. Vaughan—to whose essay reference has already been made—adds still another inconvenience to the tight sleeve. “I once knew,” he says, “a woman come to be bled whose gown sleeve was so tight that the blood could not be stopped till she was persuaded to cut it.”

*Tight Lacing.*—The subject of tight lacing has been for many years the *pièce de résistance* of all who have dealt with the hygienic aspects of dress. The popular lecturer, the popular writer, and the popular artist, have all expended considerable pains and energy upon the subject. It has been attacked with the most violent abuse, and condemned with the bitterest invective, and there are few ills to which flesh is heir that have not been ascribed by some one or another to this fashionable practice. In dealing with the matter, there would appear to be a tendency to reckless exaggeration and sweeping assertion, and a disposition to treat the subject with explosive and hysterical vigour. The practice of tight lacing is no doubt bad in more ways than one, but the disappearance of the fashion is not likely to be brought about by the ill-considered abuse and imperfectly substantiated statements. Few, for example, could treat with other than an incredulous smile the assertion of an American physician that tight lacing “has done more within the last century than war, pestilence, and famine towards the physical deterioration of civilised man.” And coming more to facts, one can only regard as remarkable the experience of a lady doctor who, at a *post-mortem* examination of some women with “the broad peasant waist,” found that “in one case the liver had been completely cut in two, and was only held together by a calloused bit of tissue.” This condition might have existed in the case referred to, but

there would be few who would be bold enough to ascribe it to faults in dress in a female with "the broad peasant waist." I shall endeavour, therefore, in the following remarks to keep as closely as possible to actual facts, and to avoid conclusions that may be open to the charge of being strained and biased.

Although the corset is, comparatively speaking, a modern production, yet the practice of constricting the waist would appear to be of some antiquity. Contemporary with the origin of the fashion there no doubt came solemn warnings as to its evils, and, according to Cerviotti, Hippocrates—who died B.C. 361—vigorously reproached the ladies of Cos for too tightly compressing their ribs, and thus interfering with their breathing powers. Those who are interested in the history of this extensively abused article of dress will find a good account of its supposed origin and of its gradual development in Dr. Leroy's monograph, "*Recherches sur les habillements des femmes.* Paris, 1772."

In the first place, as a matter of common sense it must be owned that tight lacing cannot occupy a very high position. Considering the subject quite apart from any æsthetic grounds, and quite apart from any hygienic influences, the compression of the ribs and abdominal walls in a young and perfectly developed woman must appear strangely unreasonable. I do not open up the question as to how far women whose figures are ill formed or unsightly are justified in tight lacing to produce a more normal appearance, but take rather the simple fact of a female in robust health and of perfect outline who thinks fit for certain reasons to deform the body. In the strictest sense of the term, the body of a normal woman who is tight laced must be regarded as deformed. Through most ages and among most peoples some deformity of the body has been at one time or another fashionable. Professor Flower, in his admirable little book on "*Fashion in Deformity*," has dealt with many of these.

Certain Indians, for example, think fit to flatten the head by means of pressure applied to the growing skull. The Chinese lady cramps her foot until it is neither fit to look at nor to walk upon. Among other nations it is fashionable to wear a bone thrust through the nose, or to deform the lower lip by inserting a disc of stone or metal beneath the skin. The civilised European of the present day prefers to compress her ribs, and to produce a certain modification in the outline of the body. As evidences of intelligence and of a reasoning faculty, these practices must all occupy about the same low level, and it is remarkable that in highly civilised nations—prone to recognise the absurdities of other less favoured peoples—the production of bodily deformities should still be an essential item in fashion.

As a matter of beauty, the claims of the constricted waist have been somewhat severely criticised and opposed. Many of those who acknowledge that tight lacing may possibly be injurious to the health, and own that the practice in the abstract is not sensible, would yet contend for its maintenance, on the grounds that the narrow waist adds to the beauty of the outline, and is the subject of much admiration. A desire to be attractive and a love for admiration are potent influences on the female mind; and but a scanty knowledge of human nature would assure us that, with many, those influences will outweigh distant fears of impaired health. In discussing this matter, therefore, it is impossible to avoid some consideration of the æsthetic claims of the narrowed waist. In an anatomical sense, the most perfect outline of the female figure would be represented by that of a nude, young, normally developed woman. Such a figure would, it is well known, present a waist some 26 or 27 inches in circumference; that would be regarded by many with absolute horror. Now, in all the most excellent attempts that art has made to give expression to female loveliness, this outline of the healthy and perfectly constructed



woman has always been reverently preserved. It is the outline that has been made famous by the grandest statuary of ancient and modern times, and that has been the glory of the painter since the earliest days of art. Such an outline is well represented by the famous Venus de Medici (Fig. 1). Side by side with the drawing of this marble is a representation of a narrow waist—by no means extreme—which, to ensure freedom from exaggeration, has been taken from a photograph (Fig. 2). There are some who would say that the Venus is coarse and unwieldy in outline, and maintain that the more modern figure gives a pleasant impression of trimness, and presents altogether a more agreeable configuration. Without discussing the matter at length, it can only be pointed out that the figure of Venus is the figure of anatomical perfection, of complete development, and of perfect health. If the outline be coarse and repulsive, then is nature coarse, and the expression of simple bodily vigour a thing to offend the eye. In the Venus there is a gentle sweep from the shoulder to the hip, all parts are in proportion, and the actual outline of the body precisely accords with the principles of beauty. In the modern figure there is an abrupt constriction of the waist; the shoulders and hips appear ponderous by comparison, the outline is pronounced and lacking in simple ease, and, so far as the anatomical eye can view it, the proportions of the body are lost.

One point remains to be noticed; there are some who, while they acknowledge the beauty of the outline of the nude figure, maintain that that outline is not adapted to the body when draped with clothing. They assert that the perfectly developed nude figure cannot be accepted as the standard upon which to judge the fittest outline of the clothed figure. They assert that the dress conceals the outline of the lower extremities, and substitutes an outline that is perfectly different, and that is not consistent with the



Fig. 1.—The Venus de Medici, showing the natural outline of the body.



Fig 2.—The outline of the body produced by tight lacing. (From a photograph.)

configuration of the normal waist. It is insisted, moreover, that inasmuch as in the female the natural outline of the extremities cannot be decently represented in a clothed figure, the entire proportions of the body are altered, and so altered as to render a waist of natural dimensions no longer desirable. Thus is opened up the question as to how far any form of garment that reproduces the configuration of the nude figure is to be admired. Those who advocate the views just detailed maintain that some constriction of the waist is necessary to the female figure when dressed, in order to restore proportions that have been lost by the concealment of the lower limbs, and support their argument by mathematical data. I imagine that the decision of such a matter must be a question purely of individual taste and judgment, and to such a censorship the subject must be left at present. For my own part I hold the belief that that dress is the most becoming to women which the most accurately reproduces the exquisite outline of the nude figure, provided that such a costume offends in no way the strictest dictates of modesty.

One erroneous impression as to the anatomy of the female body may be conveniently noted in this place. It has been many times declared that the amount of "waist" varies in different women, and that some are naturally provided with a tapering waist. In answer to those who are impressed with this belief, it may be said that the amount of constriction that constitutes the waist does not vary in bodies of like size and of like development. Like all other anatomical proportions, the proportions of the waist are constant, other things being equal. If, however, the hips are unduly prominent, or unduly dwarfed, the waist may appear in the one case more distinct and the other less obvious. Obesity may obliterate the waist, and emaciation make it more pronounced. Young children and young girls have a less definite waist, owing to the fact that their hip bones are

relatively as well as actually smaller than are the same parts in the fully developed. No woman, however, enters this world with the "wasp-like waist" ready made, and under no circumstances can the fashionable constriction be developed without artificial means. This assertion is not affected by the fact that the narrowing of the trunk is, in some individuals, more easily produced than in others.

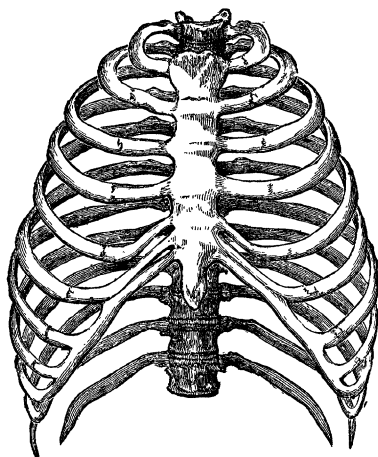


Fig. 3.—Natural Form of the Chest and Ribs.

We are now in a position to consider in detail the effects of tight lacing upon *health*.

The natural waist, such as it is, consists of a narrowing of the trunk in the interval between the last of the ribs and the top of the hip bone. A reference to the normal skeleton will show that this interval is by no means extensive, and that it affords the only opportunity for the development of a natural constriction of the soft parts. A study of the same diagram will demonstrate that no considerable or even moderate degree of constriction would be possible without a

proportionate bending in of the lower ribs. The human skeleton is provided with twelve ribs on either side. The seven upper ribs are tolerably firmly fixed to the spine behind and to the breast bone in front, so that their position cannot be greatly altered by compression. The five lower ribs are termed "false" ribs, and are only indirectly connected with the breast bone in front; the last rib, and the

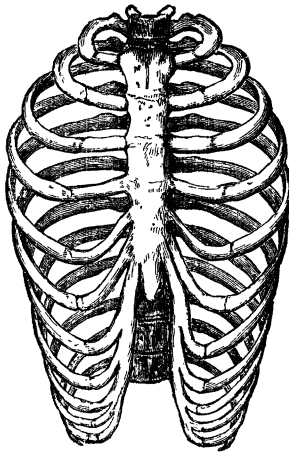


Fig. 4.—Deformed Chest, after tight lacing.

last but one, being quite free from any attachments in front. It thus happens that these five lower ribs, having somewhat insecure union with the body, are so elastic that they can be more or less pressed out of place without great expenditure of force. Indeed, I have been surprised, in experiments made upon the dead body, to find to what a considerable alteration in form these parts will submit if much pressure is brought to bear upon them. In tight lacing advantage is taken of these well-named "false" ribs, and it is upon them that the brunt of the constricting force is made to

come. In the hour-glass figure produced by extreme tight lacing, the narrowest part of the artificial waist corresponds to the site of the natural waist. The tapering outline above this represents the result of the compression of the lower ribs. But below the site of the natural waist, the line of the body curves out again with considerable abruptness, the curve representing the hip bones, that from their substantial build and firm connections are unaffected by the pressure. The alteration produced in the anatomy of a woman who laces tightly to any degree is very considerable, as may be seen by comparing the two skeletons depicted in Figs. 3 and 4.

When tight lacing is first commenced, the false position the parts are made to assume is only temporary ; but when the practice has been long continued, the deformity becomes more or less permanent, and the constriction of the trunk is nearly as marked when the stays are off as when they are on.

The circumference of the waist in a perfectly developed and normal woman is from 25 to 27 or even 28 inches. This may be considered as the proper measurement of the part. The size of the artificial waist of course varies. During a time when narrow waists were particularly fashionable, a Frenchman observes that a perfect female waist should measure no more than 16 inches—a measurement that about corresponds to the circumference of the neck of an athletic man. The fashionable waist at the present time, is, I am told, from about 20 to 22 inches—a circumference that indicates no small amount of compression. It must be noted also that tight lacing not only alters the dimensions of the waist, but it also entirely changes its outline. The normal waist, as seen in horizontal section of the body (see Fig. 6), is more or less oval in outline, whereas the artificial waist is, or should be, perfectly round (Fig. 7).

The effects of this practice upon health may be considered under the following heads :—(1) The effects upon the viscera or internal organs. (2) Upon respiration. (3) Upon the circulation and the heart's action. (4) Upon the muscular apparatus of the trunk ; and (5) upon the general outline of the body.

1. *The Viscera.*—The position of the chief organs concerned is shown approximately in Fig. 5, that displays the anatomy of the Venus of Milo. Arching across the body and separating the cavities of the chest and abdomen is the great muscular partition—the diaphragm. On the right side this extends nearly as high up as the nipple. Above the diaphragm, and resting upon it, are the heart and the two lungs. Below it is seen the liver, a large gland that stretches nearly from one side of the abdomen to the other, and that should extend no lower than just beyond the line of the right ribs. Above the liver extends as high up as the diaphragm, with which it is in contact. Below the liver, in the left side, is the stomach, and beyond the stomach the spleen, covered by the ninth, tenth, and eleventh ribs, while between the lower ribs and the hip bones are the two kidneys. The rest of the abdomen is occupied by the pancreas and intestines. Now all these viscera come more or less

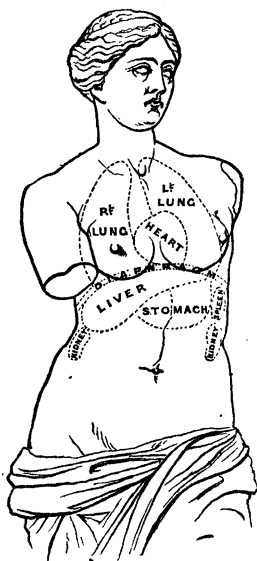


Fig. 5.—The Venus of Milo, showing the natural position of the viscera.

within the grip of the constricting force, although in the line of the narrowest part of the waist will only

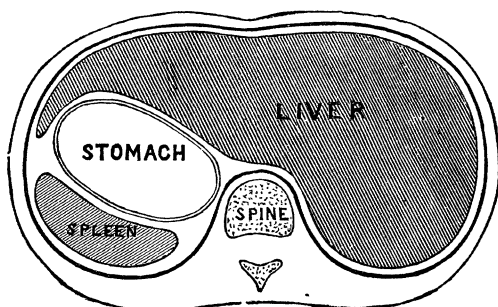


Fig. 6.—Section of the Body with a natural waist, showing the space available for the viscera and their natural position.

be found the intestines, and perhaps the kidneys. The abdominal viscera suffer, of course, the most, while the heart and lungs are only indirectly acted upon.

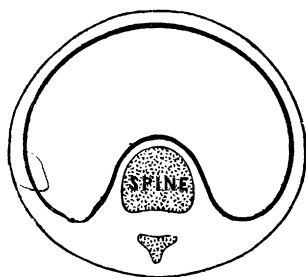


Fig. 7.—Section of a Body with a deformed waist, showing the altered outline and the greatly diminished space available for the viscera.

There is a common impression that there is plenty of empty space somewhere inside the body, and if, by narrowing the waist, the organs *are* pressed out of their proper place, then they simply occupy some part of the spare room with which the human body is supposed to be so lavishly provided. I need scarcely

say that there is not one fraction of an inch of superfluous space in the body of man. The organs fit the



one against the other so closely that if one become enlarged or displaced the effect of the change is observed upon its surroundings. In Fig. 6 the intimate mutual relations of the chief viscera are shown, and the closeness with which they fit the one against the other. If the natural waist be constricted to a size represented relatively by Fig. 7, it will at once be obvious that something must happen to the viscera. They must either be pushed up or pushed down, as there is no room for them in the line of the constrictive force. Fig. 8 shows diagrammatically a horizontal section through the lower part of the chest. It will be seen from the engravings that any movement upwards of the liver or any increase in its dimensions must affect the organs that are here adjacent to it—viz., the heart and lungs. Let all those, therefore, who practise tight lacing (if even to a slight extent) distinctly understand that the narrowing of the waist is effected mainly at the expense of the internal organs. The smaller the waist you wish to obtain, the more must you compress those organs. It is no question merely of squeezing in skin, and muscle, and bone—it is a question of squeezing in lungs, and stomach, and liver. An examination of the body after death of those who have practised severe tight lacing shows forcibly the effects of the practice. The liver is found pushed down, and more or less dislodged from its proper place. Moreover, it will appear indented by the ribs, and these indentations mean that the ribs have been so forcibly driven into the liver as to leave permanent indications of that fact. In like manner the stomach will be dragged out of position and is often structurally altered. The diaphragm is pushed up, the lung space is encroached upon, and the heart often suffers no inconsiderable displacement.\*

\* For cases examined after death, see, as examples, *Lancet*, vol. i., p. 256, 1871; *ibid.*, vol. i., p. 675, 1868; *ibid.*, vol. i., p. 5, 1861 (two cases).

How does all this affect the health? The liver is an organ whose importance in the general economy cannot be well exaggerated. Through it passes the blood concerned in digestion, and in addition to this the organ itself takes an important and essential part in the act of digestion. The result of the pressure from tight lacing is that the circulation through the liver may become impeded, and the function of the gland disturbed. As a result of this

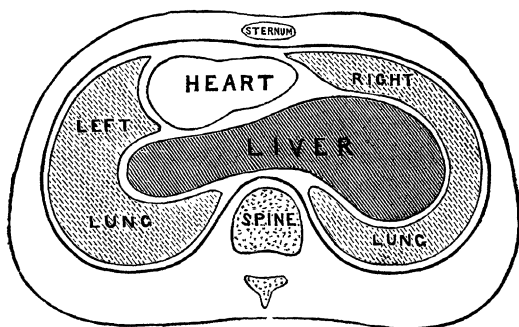


Fig. 8.—Section of the body through the lower part of the chest, showing the viscera displaced by tight lacing.

(aided by changes elsewhere), various forms of dyspepsia become common, and following upon them may come some part of that general malnutrition often noticed in the miniature-waisted. It has been pointed out that the malady known as gall stones is more common in women than in men, and it has been suggested, with some reason, that this disproportion is due to the peculiarities of female dress.\* Pressure upon the stomach may cause gastralgia, indigestion, nausea, vomiting, and other inconveniences. A serious and sometimes fatal disease—ulcer of the stomach—has been shown to be capable of being produced by the practice

\* *Med. Soc. Trans.*, vol. v., p. 18, 1881.

of tight lacing, and to the same practice may often be assigned many forms of colic, and that ailment known to the laity as "spasms." Upon the organs peculiar to the female the pressure effects of tight lacing have a particularly baneful effect, and there is no question but that the practice has led to serious and incurable affections of those parts. A recent author, dealing with these diseases, recognises improprieties of dress as a frequent and vigorous cause of these special ailments, and points out the manner in which displacements of the womb can be produced by constricted waists.

2. *Respiration.*—The diaphragm is a muscle concerned solely in the act of breathing, and its function therefore is of the highest importance. It unfortunately happens that the attachment, or base of action of this muscle, is represented by the very ribs that help to form the hour-glass waist. The result is, that in a tightly laced individual the diaphragm can have but little action, and the breathing power becomes thus seriously restricted. A simple experiment with the spirometer will show that a woman, even if she adopts but a slight constriction of the waist, has much greater breathing capacity with her stays off than with them on. The breathing in tight lacing, however, is not only impaired by interference with the diaphragm, but also by the constriction of the ribs. In the act of respiration the ribs move freely up and down, but when the body is gripped by a corset, the movement of the lower ribs can be scarcely possible. In addition to these evils, the lungs themselves must be subjected to a more or less serious compression. It is easy to surmise how this tampering with important organs will affect the general health. Air is essential to life, and it must be breathed freely and fully. There are few who have not some idea of the effects of an insufficient

\* Dr. Thomas: "Practical Treatise on the Diseases of Women," p. 45; 1881.

supply of pure air. The tight-laced individual may be surrounded with plenty of oxygen, but so compressed are her breathing organs that she cannot draw it into her lungs. She is in the position of a person starving in the midst of plenty. Any one who has watched a wasp-waisted lady after a dance, must have noticed the unsightly and exaggerated heaving of the upper part of the chest, which is merely an expression of Nature's efforts to obtain a proper supply of air.

Apart from these immediate effects there are certain remote effects. Among these may be mentioned the languor, the unfitness for vigorous exertion, the sensation of lassitude of which so many tightly laced ladies complain—symptoms due to no small extent to the persistent and gross interference with the natural act of breathing, aided by the malnutrition incident upon impaired digestive functions.

3. *Circulation.*—As already stated, undue constriction of the waist may cause some displacement of the heart, but it also serves to seriously embarrass the general circulation. This is effected mainly by an interference with the blood current in the lungs and great abdominal viscera, whereby an unnecessary strain is thrown upon the heart. The victims of miniature waists are often troubled with palpitation, and are liable to faint, or at least feel uncomfortable after unusual exertion. Two or three cases have been recorded in the medical journals of death from apoplexy in young women who were extravagantly tight-laced. A visible disturbance of the blood circulation of the face has long been popularly associated with the tapering waist, and it is a common taunt to assert of a much-constricted woman that her corset is too tight to allow her to sit down without her nose becoming red.

4. *The muscular system of the trunk.*—The injurious effect of tight corsets upon the muscles of the back is very

obvious. The spinal column is kept erect by a large number of important muscles that run down the whole length of the trunk. It is well known that the more a muscle is exercised within reason, the larger and more vigorous does it become; the disused muscle, on the other hand, becoming wasted, flabby, and greatly impaired in strength. When close-fitting and rigid corsets are used the responsibility of supporting the back falls to a great extent upon the corset; the function of the muscles is more or less superseded, and from long-continued disuse they become wasted, shrunken, and enfeebled. They undergo, indeed, the same changes that the muscles of a man's arm would undergo should he think fit to keep the limb fastened to a board for any length of time. The back of a woman who has long worn stays is emphatically ugly. It will be found to have lost its agreeable outline; the shrinking of the muscles will have caused the bones to appear unduly prominent, and the general aspect of the part will be flat, inert, and expressive of defective development. During the period of growth the muscles require frequent and vigorous exercise; and if young girls, and even young women, persistently wear stays, it follows that their muscles suffer unusually; the function of those muscles is absorbed by the corset, and the longer these so-called "supports" are worn, the more indispensable do they become, and the more completely are they relied upon for the support of this most important part of the body.

Muscular weakness in the structures that maintain the erect position of the spine may lead to curvature and other deformities of the back, and thus it is that the use of rigid corsets in young people has been so generally condemned by surgeons as a most efficient means for producing spinal ailments.

In the same way the use of corsets tends to weaken the abdominal muscles, because they, to a certain extent, absorb

the function of those muscles, and allow them to waste from disuse. Thus some undue protuberance of the abdomen is not uncommon in those who have long worn stays, and this additional deformity has necessitated an additional evil, in the form of certain abdominal belts.

5. *The general outline of the body.*—Not only does tight lacing affect the outline of the figure at the waist, but it must produce changes also in the configuration of other parts of the body. It tends, in the first instance, to make the shoulders high and square. This is due to the expansion of the upper part of the chest that is compensatory to the compression of the lower part. At first the high and square shoulders of tightly laced women may not be considered to be unsightly. The body is certainly made to assume a somewhat triangular outline, and the graceful slope of the shoulders is lost. But this change in figure is tolerated as seeming to exaggerate the smallness of the waist, for the wider the shoulders and the broader the hips the more microscopic does the waist appear. As years advance this deformity of the upper part of the body usually becomes more pronounced, and is unmitigatedly ugly. The high shoulders become round, cumbrous, and unsightly, while the increased breathing efforts of years will have caused an undue prominence of the upper part of the chest, that adds to the general shapelessness. Tight lacing, moreover, can never allow of a graceful and easy carriage. The introduction of a rigid stiffness about the middle of the body will quite prevent that, and will render most of the movements constrained and angular. If the power of tight lacing for causing wasting of muscle be borne in mind, it will be understood that of all means that the ingenuity of man could devise for preserving the youthfulness of the figure, there is perhaps none that will prove more useless, or that will more completely defeat its own purpose, than the persistent wearing of an arrangement of steel and whalebone.

In concluding this part of the matter we might approach the question so often asked: "*Are stays a necessity?*" Many women assert that they derive great comfort from stays, that they support the body admirably, and that without them the wearer feels inclined to "drop to pieces." All this may be perfectly true. But what significance must we attach to the statement that certain women cannot possibly do without stays? Do they mean for one moment to assert that the human body is so ill constructed and so badly adapted for its purpose in life that it has to depend for its integrity upon the productions of a corset maker? Such an assumption is simply outrageous, the true explanation being that by the persistent use of stays the muscles of the back have become so enfeebled (from prolonged disuse) that they are no longer able to support the spine. Those who declare, therefore, that they cannot do without stays, adopt the argument of the opium eater who maintains that he cannot do without his opium. The long-continued use of the drug has so impaired his system that he feels a constant craving for it. And those who cannot exist unless braced up by corsets have so enfeebled a part of their system that they cannot do without the support upon which they have so long depended.

Such, then, are the principal evils—and they are neither few nor insignificant—that exist in the ordinary female attire of the present time. It now remains to endeavour to indicate the means whereby these evils can be done away with, and to point out in a general manner the requirements of a healthy form of female dress.

*A Hygienic Costume.*—In the first place woollen materials of some kind or another should be worn next to the skin, and should replace the linen garments that are so commonly worn and that are for so many reasons objectionable.

The garment that comes in immediate contact with the skin should be shaped to the outline of the body, so that it may fit comfortably and without compression, and in order that superfluous weight and needless folds and creases about the waist may be done away with. The garment, moreover, should be provided with sleeves, so as to clothe entirely the upper extremities, and should reach as high as the root of the neck.

A continuation downwards of the same article of apparel may clothe in a like complete manner the lower extremities, and by such arrangement avoid the suspension of needless garments about the waist. Additional warmth for the lower limbs should be provided by additional clothing applied to each extremity separately, and the wearing of petticoats should be avoided so far as is consistent with the requirements of decency and a reasonable demand for ornamentation and display. The Viscountess Harberton has designed a dress, known as the "divided skirt," that is intended to meet some of the principal objections raised against the ordinary female costume of the time. By means of this dress each limb is separately clothed by its own "skirt," and the extremities are thus clad by what are practically trousers. By an ingenious arrangement of the material, however, the division between the two limbs is scarcely obvious, and the general aspect of the costume is much less pronounced than may be imagined. This form of garment is certainly sensible and fully in accord with hygienic principles, and it only remains to be seen how far it will fulfil the sentimental and æsthetic requirements of modern dress (Fig. 9).

Under no circumstances should any portion of the dress be allowed to constrict the body or press unduly upon any part. If garments have to be applied from the waist, they should be suspended rather from the shoulder by braces, in the same manner as are the nether garments of men. Or if,





Fig. 9.—THE DIVIDED SKIRT.

by reason of sloping shoulders or from other causes, braces are objectionable, the garments that require suspension may be attached by buttons to a "bodice" made of some fairly stiff material, and continued over the shoulders. All bands about the waist are highly objectionable, and are, moreover, quite needless. Specially should care be taken that the articles of dress are so arranged as to cover the body evenly and maintain it everywhere at a proper temperature. The weight of the garments worn should be reduced to a minimum, and all such absurd appendages as "bustles," "panniers," and "crinolettes" are to be rigorously condemned, not only on account of their weight and the needless local warmth that they encourage, but because they appear somewhat inconsistent with the intelligence of a people who are by so many generations removed from the extravagantly attired savage.

With regard to stays, I would say that corsets composed of rigid bars of steel and of many whalebones are necessary to no woman who is neither diseased nor deformed. I would not go so far as to say that stays of all kinds should be entirely given up, but would allow that in certain individuals a modified corset, slightly stiffened, and incapable of exercising constriction, is necessary for the sake of both comfort and appearance. Under no circumstances does a young girl require stays of any kind, and in the majority of young women they are equally needless and almost equally injurious. One sometimes hears the remark that a young girl who is growing rapidly requires some support for her back, and it naturally follows that that support is supplied in the form of stays. No delusion can be more complete than this. The weakness that is usually experienced in the back of a young girl is muscular weakness. The muscles in ninety cases out of a hundred have not been properly exercised, and the child, instead of being allowed to romp, has been kept propped up on a music

stool, for hours daily, "practising." If the muscles that support the spine require strengthening, let them be strengthened in the only way that nature provides, viz.—by exercise.

Let the child modify her pursuits, and indulge in some more reasonable form of muscular movement than is at present considered proper for most young girls. To wear stays is actually to increase the evil, and would only be equalled in folly by the action of a man who, finding the muscles of his arm weak from disuse, would proceed to bandage them up and exercise the limb still less. With regard to fully developed women, I think that no species of corset is necessary for those who are thin and slight in figure. For the purposes of appearance and for the more ready adjustment of dress they may wear a bodice composed of some stout material, but a cage of whalebones and steels is as needless as it is injurious. On the other hand, for women who incline to stoutness or who present an undue prominence of the bust, as well as for those who are mothers, a modified and simple form of corset is necessary for comfort, if for no other reason. The corset should be made of some stiffened material, should be slight in make, free from all rigid materials, and devoid of any constricting bands. It will fulfil all the points that the more temperate in dress consider necessary, and at the same time will have in no way an injurious effect upon the health.

*The Hands.*—The hands, like the face, require very little covering, while, on the contrary, their usefulness is apt to be somewhat interfered with by gloves. The blood supply of the hand is liberal, and the circulation within it free, and it is thus well able to resist ordinary cold, and to be indifferent to ordinary fluctuations of temperature. Except in quite cold weather, gloves may be regarded rather as ornamental than as necessary to a perfect attire. The

constant wearing of tight kid gloves must somewhat impair the circulation of the part, and render the hand attenuated by discouraging the proper use of its muscles. A white and emaciated, or "delicate" hand is, however, at the present time admired in ladies, and there is, therefore, some reason for constant glove wearing. Individuals with feeble circulations, as well as those who are liable to chilblains on the hand and to chapping on exposure, are obviously more in need of some hand-covering than are persons in perfect health.

According to Dr. Buck, silken and woollen gloves are more apt to lead to chapping than are gloves made of kid or dog-skin. The kid glove, by the density of its structure, affords protection against wind, but as a protection against cold it is comparatively valueless.

The muff must be included in the consideration of hand clothing. This strange appendage is probably regarded as purely ornamental, for as a means for keeping warm the hands it is ridiculously extravagant. It has, I presume, the doubtful advantage of allowing ladies to wear thin gloves with impunity during cold weather. But against this advantage must be placed the weight of the appendage, the muscular effort required to support it, and the impediment that it offers to an easy gait by demanding that the wearer should walk with her hands pinioned in front of her..

*The Feet.*—The blood circulation in the foot is neither so copious nor so free as it is in the hand. This depends partly upon the more dependent position of the extremity, and partly upon its greater distance from the heart as the centre of the blood supply. It is desirable, therefore, that the foot should be well protected, and so covered as to best prevent any loss of the normal animal heat. A multitude of evils have been ascribed to cold feet, many rightly, and many, perhaps, without sufficient reason. A greatly

diminished amount of blood in the lower extremities means an unnecessarily large amount elsewhere, and consequently an unequal circulation. It is not difficult to understand that this irregularity in the blood supply may cause various evils, and, whether injurious or not injurious, it must at least be owned that cold feet are not comfortable.

*Stockings* and *socks* should be made of some woollen material that may vary in thickness and density according to the time of the year and the general requirements of climate. Woollen fabrics are selected on account of their feeble conducting properties, and for the other reasons that have been already mentioned. Cotton stockings are in every way to be condemned. In cold weather they do not afford sufficient warmth to the extremities, and in warm weather they are apt to encourage those abrupt fluctuations of temperature that—as already pointed out—are so undesirable.

Those whose skin is unduly susceptible to woollen substances may wear silken stockings in hot weather, and in cold weather the necessary woollen foot covering may be separated from the skin by a thin stocking made of silk. It is most desirable that the sock, or stocking, should not fit so tightly as to compress the foot or alter the position of the toes, and particular objection must be taken to such stockings as are pointed at the extremity. A proper foot covering should accurately fit the foot, and be of the same shape as the sole when pressed upon the ground. Stockings that are too short are bad in that they cramp the toes, while those that are too long involve a mass of superfluous material at the extremity of the boot. Children are, perhaps, the greatest sufferers in this latter respect, being often provided with shapeless socks that, with the economical object of “allowance for growth,” contain an amount of superfluous material.

In 1792, Dr. Vaughan, of Rochester,\* strongly urged that "stockings should be made with toes, as gloves are with fingers." Such digitated stockings are to be advised, inasmuch as they more completely clothe the feet than do ordinary stockings; they are probably more cleanly, they prevent an unnecessary mass of material at the extremity of the boot, and they do not permit of the formation of soft corns between the toes. Stockings should be supported by means of "suspenders," either attached to a shoulder brace, if such be worn, or to the bodice, by means of buttons. Garters are in every way to be condemned. They compress the superficial veins of the limb, and, by driving the blood into the deeper parts, are instrumental in causing the pain and sense of weariness that is often complained of in the limbs. Moreover, this compression of the veins is more or less certain to lead in time to the development of varicose veins.

*Boots and Shoes.*—Before considering the question of boots and shoes, it will be well to draw attention to some general points in the structure and configuration of the foot.

The human foot is composed of twenty-six bones of various shapes and sizes, held together by a number of strong ligaments. These bones are so arranged that, while by the size and compactness of some of them great stability is given to the foot, by the number and articulation of the others the member derives its elasticity and its power of modifying the effects of shocks transmitted to the body. The foot presents two main arches—one extending in the long axis of the foot from the base of the toes to the heel, the other passing transversely across the sole about its centre. These arches being of greater degree in one part than in another, it happens that the inner side of the foot

\* "An Essay, Philosophical and Medical, concerning Modern Clothing," page 110.

presents a much greater amount of curvature than does the outer side. To the arch thus rendered so obvious on the inside of the foot the name of the instep is commonly given. A section of the foot (Fig. 10) shows that while the hinder part of the long arch of the foot is composed of two large bones only (os calcis and astragalus) the front part or pier of the arch is made up of many small bones, presenting a variety of outlines. By this arrangement it comes to pass

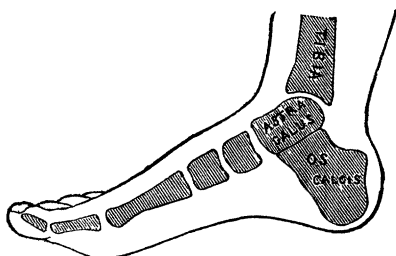


Fig. 10.—Section of the Foot.

that the posterior part of the arch gives stability to the foot, and supports (through the heel) the main weight of the body, while the anterior segments give spring and elasticity to the member. The comparative value of these two parts of the arch can be estimated by jumping from a height and alighting first on the heel (or rigid part of the arch) and then on the bases of the toes (or the elastic portion of the arch). The integrity of the pedal arches is maintained by ligamentous and muscular structures, and is essential to the proper function of the foot and to a perfect mode of progression. When from various causes the natural foot arches are lost, the individual is said to be suffering from "flat foot" or "splay foot."

The mechanism of the act of walking is somewhat complicated, but so far as our present purpose is concerned it is

merely necessary to note one important fact. Most essential to proper progression is the series of transverse joints that run across the breadth of the foot at the part known as the "tread of the foot" or the "balls of the toes." This spot is indicated in Fig. 11 by the letter "*a*." In the act of walking a free bending of the foot at this part is indispensable, to allow of the performance of certain necessary lever movements. If the line of the foot, when it rests on

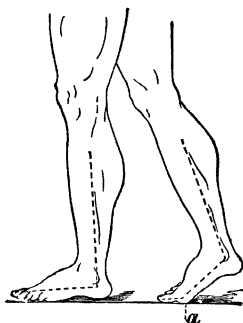


Fig. 11.—Action of the Foot in Walking.

the ground, is represented by a straight line (as in the front foot in Fig. 11), then when the heel is lifted from the ground in the act of walking, that line will no longer be straight, but will become angular opposite the bend of the foot (as in the hinder limb in Fig. 11). It will be seen at once that a boot with a rigid sole will quite prevent this action; but of this more will be said presently.

In taking note of the outline of the sole of the foot it will be seen (Fig. 12A) that the front part of the sole is broader than is the heel part, and also that the great toe is parallel to the axis of the whole foot. Now, in the shaping of a boot it will, I presume, be allowed that the boot ought to be made to fit the foot, and not the foot a boot having an arbitrary outline decided by the fashion of the time. It happens that the ordinary shoe has little or no relation to the natural outline of the sole (Fig. 13). The fashionable boot terminates in front in a more or less pronounced point, and the part occupied by the toes is usually its very narrowest part. The ordinary shoe is made on the principle of bilateral symmetry, and apparently on the assumption that



each foot is divided into two perfectly symmetrical parts. As one writer on the subject well observes, the fashionable shoe is made of a certain shape "as if the human foot had a great toe in the middle and a little toe at each side, like the foot of a goose."\*

Why this particular shape should be admired it is difficult to say. There is nothing unsightly in the perfect

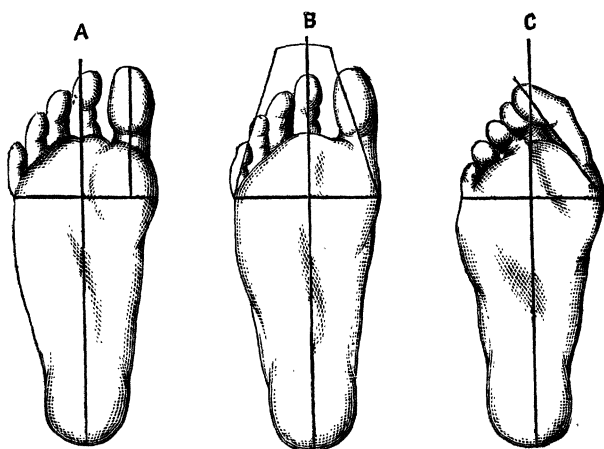


Fig. 12.—A Natural Foot. B. Foot with outline of boot. C. Foot distorted by boot. (From Prof. Flower's "*Fashion in Deformity*.")

human foot, and it is hard to understand why a boot that more or less completely reproduces the normal outline of the member should be considered as repulsive. The active spreading toes of a child's foot are certainly more to be admired than are the crushed and distorted toes of the shoe wearer; and the perfectly shaped feet made familiar by

\* "The Foot and its Coverings," by James Dowie. London, 1861.

good statuary have surely an outline that is in itself more agreeable than is the rigid and wedge-like outline of the fashionable shoe.

Fig. 13 shows the kind of impression that would be left upon the ground by a normal foot, and the utter lack of resemblance between that impression and the outline of the ordinary boot sole is somewhat unpleasantly conspicuous.

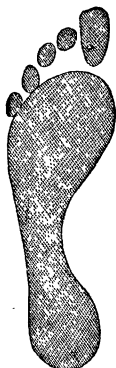


Fig. 13.—Impression of Normal Foot.

If well-developed feet are placed side by side and heel to heel, the two great toes will be found to be parallel to one another, and to touch one another almost to their very ends. If the same feet, clad in the shoes of the period, are placed in the same position, it will be found that, while the heels are in contact, the inner borders of the two soles diverge, and that the tops of the two great toes will be separated by a considerable interval.

Now, for the proper performance of the functions of the foot it is essential that all its movements should be unrestricted, that the toes should have free play, and that the great toe—which is so indispensable to the act of progression—should have a free range of motion, and maintain its parallelism to the long axis of the foot. What effects, however, do ordinary shoes have upon the feet? The toes become crushed together, and are often made to overlap one another; the great toe is no longer in a line with the axis of the foot, but is pushed outwards towards the middle line of the sole. The joints between the many bones are rendered rigid; the muscles, being unable to act, waste; the ligaments shrink, and the foot becomes a deformed, rigid, and inert block. In addition to these ill effects the delicate arch of the foot becomes broken

down, the natural spring and flexibility of the part is lost, and by this loss of movement in the foot a greater expenditure of muscular power is demanded in other parts of the body.

The distorted member becomes decorated with corns and bunions, and occasionally presents the condition known as "in-growing nail." Robbed of its natural outline, of its elasticity, of its very strength, and shrunk by long inactivity and pressure, the foot that has long worn the fashionable shoe is in truth a sorry object. So general is some deformity of the foot from boot-wearing, that among the great majority of the population a normal foot is a thing difficult to be met with. So long ago as 1857, Bonomi laments that "from the antique alone can any knowledge of what is beautiful in the adult human foot be derived,"\* and it is indeed possible, if the passion for badly shaped shoes should be of long duration, that the proper configuration of the adult foot may become a mere matter of history.

A boot, to be properly shaped, should conform to the normal outline of the sole, and should exactly reproduce the natural proportion of the foot. The foot should not be measured—as is usual—while it hangs inert and removed from the ground, but the estimate of the proper shape of the member should be formed when it rests upon the ground, with its parts spread out.†

From what has been already said about the act of walking, it will follow that some flexibility in the sole of the boot is indispensable. This is provided for by what is known as the "waist" of the shoe, but this waist is

\* "The Proportions of the Human Figure," p. 19. London, 1857.

† In connection with the present subject, see "The Human Foot and the Human Hand," by A. Humphry (London, 1861); also, "Why the Shoe Pinches," by Hermann Meyer (Edinburgh, 1860).

placed—so far as my own impression on the matter goes—too far back, and too much removed from the tread of the foot where the natural movement actually occurs.

A perfectly rigid sole to a boot destroys the main action of the foot in the act of walking, and entirely prevents that bending of the front part of the foot that has been already alluded to (Fig. 11). The evil effects of an entirely rigid sole are well illustrated by the boot commonly worn by the agricultural classes. In this boot, not only is the sole of enormous thickness, but it is rendered still more rigid by the addition of a multitude of formidable “hob nails.” It is stated that the ordinary army pattern Blucher requires a weight of 28 lbs. to bend the waist of its sole, so that the wearer of such a boot, to use the foot properly in walking, would have to expend an amount of superfluous muscular energy equivalent to 28 lbs. weight at each step taken.\*

The absolutely rigid sole of the bucolic boot serves to account to a great extent for the ungraceful gait of the ordinary yokel. The natural play of the foot and toes being lost, and the motion of the ankle much impaired, he has little use for his leg muscles, and these becoming atrophied, produce the shapeless and comparatively small calf that he will usually present. The yokel walks mainly by a swinging movement from the hip, and so far as his feet are concerned he would walk more elegantly if he were to have them amputated and a rounded stump affixed in their place.

Even the common wooden sabot is less obnoxious than is the absolutely rigid boot of the English peasant. The sabot has a curve to its sole that allows of a rolling movement of the foot, not unlike the natural bending of the foot. Moreover, it is generally loose enough to allow of

\* *Lancet*, vol. i., p. 488; 1865.

considerable play of the foot and ankle joint in the act of walking. The sabot is also, I imagine, of less actual weight than is the foot covering of the so-called clodhopper. The sole of any boot, therefore, that is not as flexible as it should be will tend to encourage in a minor degree some of the evils that are so conspicuous in the wearer of a shoe with a perfectly unyielding foundation.

Boots should be made of leather that is as soft and pliable as is consistent with strength. Some of the thin frail boots that are worn by ladies are mere apologies for a foot covering. They can neither afford a common protection to the foot, nor shield it from the cold, nor preserve it from wet and damp. Cotton stockings, and tight boots made of the thinnest possible material, are among the main causes of the cold feet so commonly met with in women. Elastic sides to boots may prove a source of evil by unduly compressing the foot and thereby interfering with its circulation.

It so happens that two of the principal veins that return the blood from the feet run just beneath the skin, and are, therefore, very readily affected by pressure. The blood being forced from the superficial veins tends to produce an engorgement of the more deeply seated vessels, with certain possible inconveniences. A case has been recorded—in the person of a medical man—where severe pain in the soles of the feet was induced by wearing elastic-side boots. The pain ceased with the removal of the elastic portion of the boots.\*

Certain obvious advantages attend the wearing of boots the upper parts of which are made of cloth or some like material. Such boots, however, could only be worn under certain conditions. Boots or shoes that are too short not only cramp the toes and tend to bend them up, but they are also apt to produce a curving of the nails that may lead to

\* *Lancet*, vol. ii., p. 718; 1866.

the troublesome ailment known as in-growing toe-nail. While it is allowed that boots that are too tight are bad, it must also be borne in mind that boots that are too large may prove to be objectionable. Such boots allow the feet to shift about within them, undue friction is thus encouraged, and feet encased in too ample shoes are apt to become abraded and to develop corns. Moreover, the loose connections between the foot and its covering render walking less easy, by creating a demand for some additional muscular exertion.

*High Heels.*—Into the matter of the comparative beauty of high heels and no heels I do not propose to enter. Shoes require heels of some kind, but they should not be out of proportion to the rest of the foot. The heel of a boot for a fully grown man should not exceed three-quarters of an inch in height, should be placed well back, and should be as large as the natural heel. The height of boot heels for other individuals can be estimated from this. Unduly high heels to shoes are objectionable in many ways, especially when they are disproportionately small. In the first place, they diminish the stability of the foot by placing beneath the natural

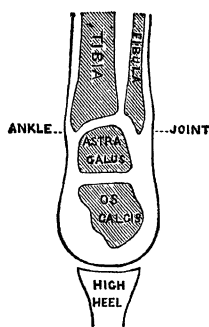


Fig. 14.—Transverse Section of Foot.

heel one more segment in the support upon which the weight of the body, as transmitted through the leg, must rest (Fig. 14). They produce a false position of the body by tilting up the heel, and by thereby placing the foot in the position it assumes when the individual walks on tiptoe (Fig. 15). The mechanism of the foot is impaired, and undue muscular exertion is demanded in the act of walking. Muscles are induced to act irregularly ;

some ligaments are stretched while others are relaxed, and the whole long framework of the foot is weakened. The muscles of the calf that are attached to the os calcis, or bone of the heel, are relaxed, and act at a considerable disadvantage, while the muscles on the front of the foot and leg are elongated and weakened. The astragalus, or bone of the foot that enters immediately into the formation of the ankle joint, is thrown somewhat forwards, and the ankle joint itself is thereby greatly weakened. For these



Fig. 15.—Longitudinal Section of Foot.

and other reasons, sprained ankles and ungainly limbs are very commonly associated with the wearing of these needless appendages to the boot. Moreover, the heel being elevated, the foot is pressed forward into the toe of the shoe, the toes are apt to become crushed up, and a curving of the toenails is not infrequently induced. These evils are augmented when the heel is placed—as it often is—far forwards on the sole of the boot. In this advanced position it will be found to be placed just beneath the arch of the foot, and by its presence in that site it not only weakens the pedal curve, but also deprives it of its action as a spring to modify shocks transmitted through the sole of the lower extremity.

As Dr. Buck well expresses it, a heel in this position has the same effect as has a block of wood when placed under the springs of a carriage.

High heels are dangerous not only on account of the general instability that they give to the foot, but also by their weakening effects upon the muscles of the limb and the connections of the ankle joint. Their small size, moreover, renders them liable to trip up the individual, and not a few serious accidents have been ascribed to these fashionable impedimenta. A graceful carriage is inconsistent with very high heels, although by long and patient practice women attain a fair degree of proficiency in the almost acrobatic feat of walking upon their tilted shoes.

As to the comparative merits of *boots and shoes*, I think it may be asserted that, under ordinary conditions, the shoe is more consistent with a perfectly healthy condition of the foot. The foot, like the rest of the surface of the body, perspires, and often this perspiration is free. It is desirable, as has been already explained, that this perspiration should be allowed to evaporate, or, in other words, to escape. Leather being practically impervious to moisture will prevent the proper evaporation from the skin if the foot be entirely enveloped in that material. The foot requires to be ventilated, and in the shoe that object is more easily accomplished than it is in the boot. When the foot is covered with a boot, the only chance of the air gaining access to the skin is afforded by the loose connections of the boot about the ankle, or by any open space in the line of the lace or buttons. Boots have been made with especial apertures for ventilation ; but such arrangements are, for the most part, very incomplete. Shoes have the additional advantages of leaving the ankle free, and of being considerably less in weight than are ordinary boots. It is significant that the foot covering adopted by those engaged in



vigorous exercise takes usually the form of the shoe, and thus we have "cricketing shoes," "running shoes," "lawn-tennis shoes," and the like.

It is said that shoes may lead to a weakening of the ankle, while, on the other hand, we hear frequently of tightly laced boots as excellent means of strengthening that joint. Assuming that the bones are sound, the integrity of the ankle joint is maintained by the muscles and the ligaments about it. A weak ankle means enfeebled muscles or relaxed ligaments; a strong ankle implies vigorous muscles and stout ligaments. If muscles are weak they can only be strengthened again by proper exercise, while the vigour of ligaments is maintained by a constant and proper use. The worst treatment, therefore, that can be adopted for a weak ankle is to enclose it in a high, tightly laced boot. Such a practice tends to exercise the muscles still less than they were before exercised, and the rigid boot taking the place of the ligaments to a great extent, offers no opportunity to those structures for a more complete development. Dr. Humphrey, speaking of this practice, remarks that it "has its parallel in the idea of strengthening the waist by stays. The notion is in both instances fortified by the fact that those persons who have been accustomed to the pressure, either upon the ankle or the waist, feel a want of it when it is removed, and are uncomfortable without it. They forget that the feeling of want has been engendered by the appliance." Children are, unfortunately, the chief victims of this mistaken treatment of weak ankles, and I can fully endorse the statement that "there can be no surer way of producing permanently weak ankles than by lacing them up tightly during childhood, and so preventing the natural development of their ligaments."\*

\* *British and Foreign Medico-Chirurgical Review*, p. 123; 1862.

### THE DRESS OF INFANCY AND CHILDHOOD.

The general principles that have been already laid down with regard to a proper covering of the body for adults apply equally to the circumstances of the young. There are certain conditions, however, incident to childhood that render the dress of this period of life a matter for special consideration.

1. Infants require to be clothed warmly; not that the temperature of the body in extreme youth is below that of the adult, but because in very early life the heat-producing powers of the organism are feeble, and therefore proper clothing is needed to prevent undue waste of such animal heat as is generated. For the first year or so of life this lack of vigour of the heat-producing powers of the body is obvious, and young children have therefore the same need of warmth in their clothing as have those still younger. There is a somewhat prevalent notion that by clothing children lightly, and by exposing them at an early period to cold, they become accustomed to fluctuations of temperature, and are, to use the term of the advocates of the practice, properly "hardened." The hardening process, it is perhaps needless to say, is a delusion and a snare, and is accountable for no small contribution to infant mortality. On the other hand, scarcely less objection is to be taken to the plan of "coddling" children up, and of keeping them at all times in the atmosphere of a hot-house. The point to be aimed at is the maintenance of an equable temperature about the child's body, a temperature that will avoid extremes, and be free from abrupt fluctuations.

For reasons that have been already given, some woollen material should be worn next to the skin, and, owing to the sensitiveness of the integument of quite young children, it is desirable that the fabric used should be of the finest possible texture.

2. The body should be perfectly and evenly covered with clothing. This point has already been insisted upon in dealing with the attire of adults. In infants and children it is a point very constantly ignored. On examining the ordinary dress of an infant, it will be found that round the abdomen and back are several closely applied layers of flannel, in the form of what is known as a "binder," while the neck and shoulders are covered but partially with some linen garments, and the arms are quite bare. To complete the system of the unequal distribution of clothing, a vast amount of totally superfluous and ornamental material is clustered about the lower extremities of the victim. In older children, moreover, while the body is perhaps properly covered, the neck, arms, and legs are left bare, and thus every inducement is offered for an unequal distribution of blood and an irregular circulation.

In the proper attiring of an infant the garments should be as few as possible in number, and, as already pointed out, should be wholly or mainly of wool. They should cover the body evenly and completely, should be high up in the neck and extended down to the wrists, and should be so made that they may be applied without turning the infant over and over. They should also be sufficiently short to allow free movement of the legs. The object of the long robe that very young children wear is not obvious. It may be excused as an occasional ceremonial garment, but as an ordinary article of attire it is a cumbrous atrocity. In infants, lower limbs can be properly clothed by high woollen socks, by which, at least, the movements of its limbs—so necessary to their development—are not hampered. The long robe of the civilised infant cramps its limbs and presses upon its feet; it is of great weight, and from a utilitarian point of view is only of service as a means of holding an object that is, by its shape and small size, not convenient to hold. It appears to me to play the part of a handle.

Other things being equal, the same remarks apply to older children. Their legs and arms and necks should be evenly and completely covered; and it is difficult to understand why they should be less perfectly clothed than the mature adult.

The infant's head should be kept cool. At birth the skull bones are very thin, and in parts defective, and the covering provided for the brain is therefore comparatively slight. Thus it happens that the circulation within the skull is more readily modified by external conditions of temperature than it is in adult life. The system of enveloping the head in flannel, or of allowing the head to bury itself in a feather pillow, tends to draw more blood to the part than is necessary or perhaps comfortable; and the ridiculous helmet-like hats that are often inflicted upon infants when out of doors are simply barbarous, not only from their warmth, but from the weight and pressure they may exercise upon the scalp.

3. The clothing should be free from constrictions of all kinds. In the first place, exception must be taken to the "binder" that is commonly worn by infants during the first few months or even years of their existence. Until the fragment of the umbilical cord has separated, one layer of light bandage round the body is desirable; but the object of tightly encircling the body for some eighteen months with several layers of flannel or calico is totally unintelligible. This article of clothing helps to maintain an unequal distribution of animal heat; it must be applied tightly or it will slip, and thus it acts as a constriction upon a part of the body that should be kept quite free. Of this mysterious article of clothing Professor Humphrey\* thus speaks. "Those mischievous two yards of calico constrict and hinder the expansion of that very region of the body where heart and lungs, stomach and liver are struggling for room

\* "Sanitary Record," p. 151; Oct., 1883.

to grow and do their work. A more pernicious device can hardly be conceived than this relic of ancient nursedom, and it is impossible to estimate the number of deformed or pigeon-chests, of hampered stomachs, livers, lungs, and hearts, with their varied attendant life-enduring infirmities and curtailment of life that must result from the use of these 'swathers' as they are called, and for which there is not the slightest necessity." The prominent abdomen of infants depends upon the relatively large size of the liver and the small size—both relative and actual—of the pelvis. This protuberance is natural, and lessens with every day of existence. The binder tends to perpetuate it and to favour the formation of a rupture in the region of the navel. The abdominal wall is made of muscle and fibrous membranes. There is no way of strengthening that wall except by exercising its component parts. The binder prevents such exercise, hinders the development of the muscles, and encourages the very deformity it is intended to prevent.

One lady, writing on this subject, after emptying the vials of her wrath upon the common bandage, advises the use of an elastic binder which, on account of its abiding pressure, is perhaps a trifle more objectionable. The same author quotes a passage from a work "*How to Manage a Baby*," in which the mother is advised to apply a graduated compress to the navel in any case where an actual rupture has formed. Such a practice is very strongly to be condemned. All such compresses and pads tend to keep patent the opening in the abdominal wall rather than to favour its closure. These various forms of apparatus are in common use, and have much to answer for. The colic of young infants, which forms so large a factor in infantile woes, is, I imagine, often due to causes in which the binder and the pad take no insignificant part.

Children's garments should be loose, and should exercise undue pressure upon no part. Dr. Lewis Smith has recorded

the case of a young infant who is supposed to have died from embarrassed respiration due to tight clothing. If constriction be bad for adults, it must be infinitely worse for the young, for those whose bodies are in active growth, whose tissues are delicate, and whose bones are but imperfectly solidified. At the same time it is desirable to avoid the other extreme; and it should be borne in mind that a child may be clad too loosely. This especially applies to the looseness of children's clothes about the neck. So loose are the under garments and dress that it is often possible to see the entire length of a child's back by simply drawing back the clothes at the neck. This very free admission of air to the integument is rather more lavish than is desirable, and often involves certain additional garments in order that the child may be kept warm.

4. Under no circumstances should any garments be attached to the waist. Any constriction of the waist of a growing child is nothing less than a barbarity. The dress, the petticoats, &c., should be supported by proper means from the shoulders, or be attached to some loose bodice that descends as low down as the waist.

5. The garments of children should be as few in number and as light in weight as is consistent with a proper protection of the body. The attire of a young infant is usually a serious offence against this proposition. The child is enveloped in a number of garments, some insignificant in size and others of extravagant proportions. It is weighed down by robes and decorated gowns, and on special occasions is encumbered with a cloak containing enough material to clothe the shoulders of the nurse who carries it.

The remedies available for these and other defects in juvenile dress are merely matters of common sense.

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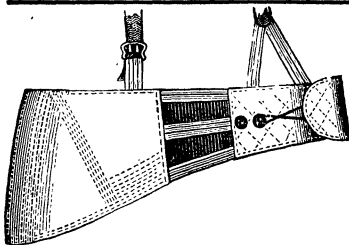
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